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New Series, Vol. VIII
Old Series, Vol. XXVII | Chicago | JULY, 1912 | New York | No. 7

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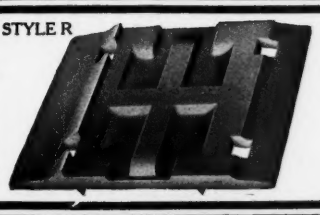

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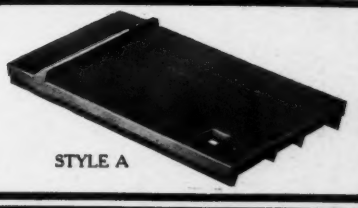

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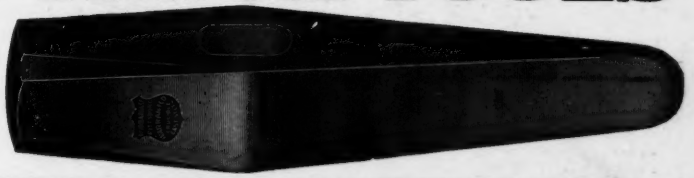

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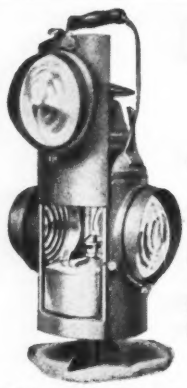

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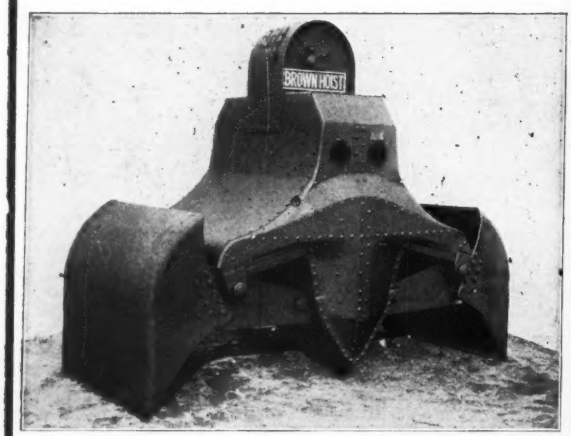

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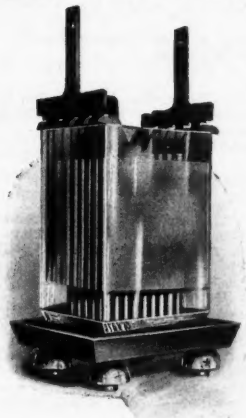

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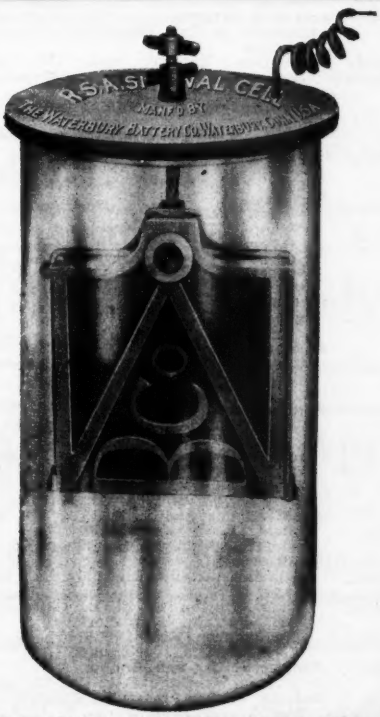

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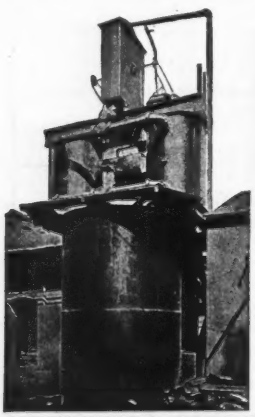

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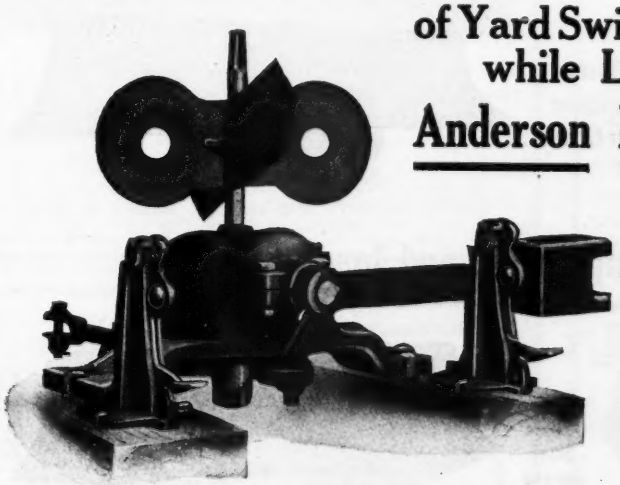

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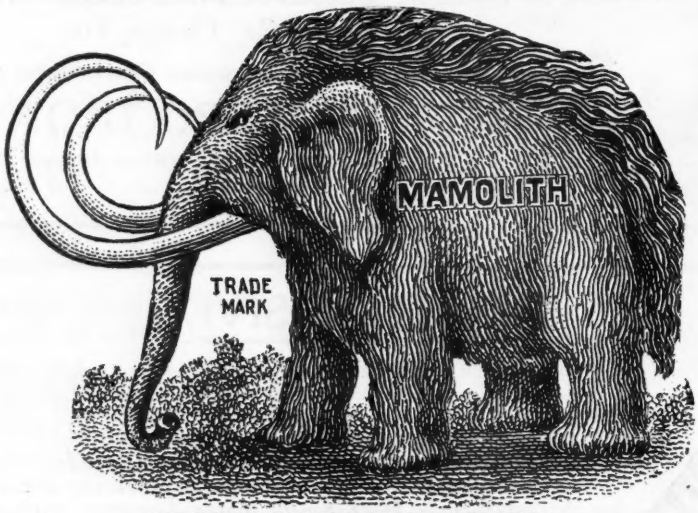

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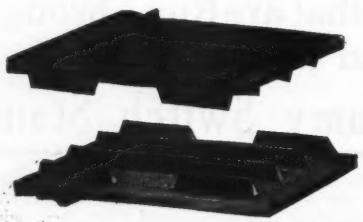

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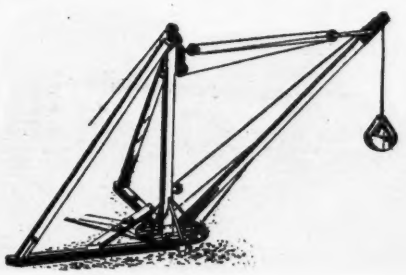

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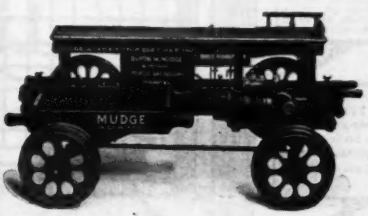

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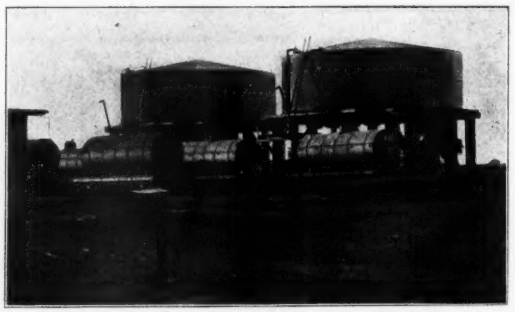

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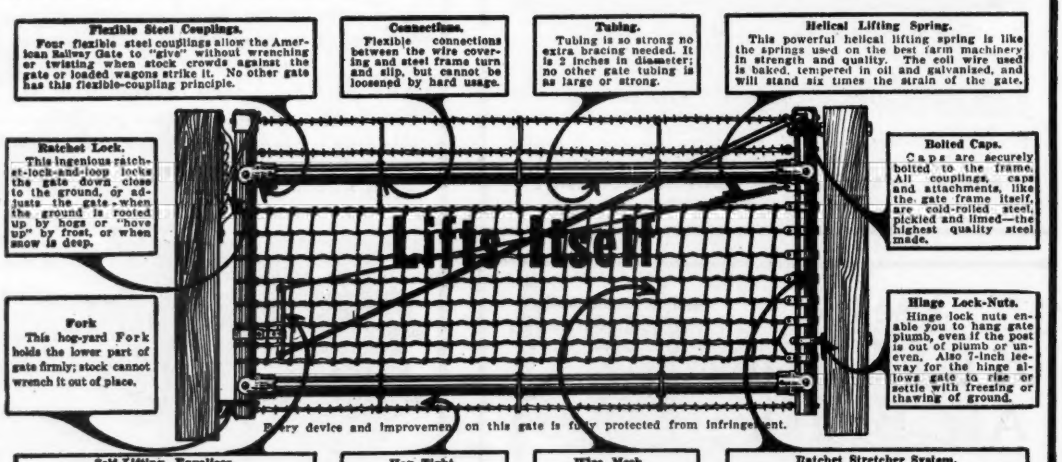
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Substitution of Power for Hand Labor.

THERE ARE many places in our large industrial plants where a single machine is now doing the work which formerly required the labor of many men. The number of laborers dispensed with in some cases runs into the hundreds, with a single machine. Industrial plants usually are isolated. Each has a separate organization in control, with a head who is the owner of the business or is directly responsible to the owner. The man in charge of a small plant is in a position to get close to his men. He is likely to be quick to see and investigate any machine which promises a decrease in the number of laborers employed and a resulting increase in dividends.

On the railways we have a different organization. The man who is in final control of expenditures is far from the men who do the actual work in the numerous departments. The engineer or the supervisor may be compared to the superintendent of an industrial plant. He must be in close touch with the men. He must investigate thoroughly those appliances which give promise of a reduction in running expenses. You will find many such men. Their minds are receptive to new ideas, but they are conservative enough to give each proposition a thorough investigation before favorably or unfavorably committing themselves. The man who has the time to carry on such investigations frequently has a great deal of trouble in getting his superior to devote a sufficient amount of time to what may appear as a detail, to come to any definite conclusion in a given case. The superior dislikes to put the stamp of approval on the requisition of a subordinate, for machinery without which the job seems to be progressing fairly. He hasn't the time to investigate, so he postpones indefinitely. The man who is positive he is right in ordering equipment should be aggressive enough to keep on hammering away until he gets it. He must not appear so insistent as to be a nuisance. Arguments can be put down on paper and gotten up in such a manner that the superior can get at the facts with a minimum amount of trouble. Many a man is getting ahead in railway work just on account of his aggressiveness in matters of this kind. He finally makes others believe he is right. He gets appropriations and equipment while his less aggressive associates wonder why the other man gets the material.

In railway work there is much room for the substitution of power for hand work. The construction and maintenance departments offer opportunities in this line which should not be neglected. The great obstacle in the way is the opposition of higher officials to investing money in equipment. This is especially true of equipment which is of use only in heavy construction and maintenance, possibly for a limited period during the year. Then there is the added difficulty of making the officials see that there is to be a large saving. The old motto, "Leave well enough alone," is all right. But where is the man so unprogressive as to admit his work is incapable of improvement? When have we reached the "well enough" point? Certainly not as long as contractors are doing work and making good profits on prices as low as the company forces can do the work themselves.

We must grant that the contractor has an advantage. He buys equipment and pursues one line of work, usually highly specialized. His machinery is at work whenever he is at work, while on a railway heavy construction and some maintenance appliances are idle in the winter when company business is going on in the usual manner.

One of the most important applications of power to railway work is, we believe, the substitution of gasoline motor cars for hand section cars. There are many arguments that might be cited, one of the most important being that it can

be made a strong inducement for obtaining and holding section forces.

There are many other applications of power, among which might be mentioned: Light cranes for loading and unloading rails or ties; dump cars for handling dirt for fills; unloaders and spreaders for handling earth for fills, and also for unloading and spreading ballast, and there are many others.

Another reason it is so extremely hard to convince higher officials of the economics which can be effected is the lack of authoritative detailed costs of railway work. When such costs are obtainable, the engineer can make a strong argument to support his requisition by showing a comparative detailed statement of costs in dollars and cents, being sure to include overhead charges.

A Mistake.

Our attention has been called to the fact that the construction of Wyville Interlocking Plant, described in our July issue, was wrongly credited to the General Electric Co. This plant was installed for the Chicago & Northwestern Ry. by the General Railway Signal Co., and not by the General Electric Co.

Cash Prize Contest for Articles on Concrete Construction.

THE CONSTANTLY increasing use of plain and reinforced concrete in railway construction has been commented on frequently. The adaptability of concrete, the ease with which it is made and placed with unskilled labor, the abundance and availability of the aggregates, all of these reasons and others are responsible for the growth. Hardly an engineer in the employ of a railway but has had some experience along this line. In order to bring out valuable ideas on how to handle concrete the publishers of *Railway Engineering* announce a contest as outlined below, on concrete construction. The experience of every man in this line of work will furnish some valuable pointers.

For the two best articles submitted cash prizes will be awarded. The first prize will be $25 cash, the second $15. We will publish most of the articles submitted, and will pay space rates for those not taking prizes, amply repaying you for time spent in preparing same. The award of prizes will be made by a committee of prominent railway engineers.

The contest will cover such points as—the design and layout of a concrete plant, the handling and mixing of aggregates, and distributing concrete for plain or reinforced concrete railway structures of all kinds; foundations, arches, bridges, buildings, viaducts, retaining walls, etc. The following general suggestions for an article are offered:

Arrangement of mixer plant and material tracks. What type of mixer was used and what are its advantages? How were sand, stone and cement delivered to mixer? Were the correct and economical proportions for mixture determined, and if so, how? What method was used for delivering the concrete to the forms? Number of laborers and organization of the mixer gang. Average day's work and approximate cost (if obtainable). Methods for securely supporting forms, especially if there was not room enough for ordinary braces. Drawings or photographs should be included if they will make the article more interesting and instructive.

This contest will embrace problems where concrete is placed: (1) Under ordinary conditions; (2) Under water; (3) Below water line in excavations, or where there is water flowing in under pressure; (4) In caissons or coffer dams. It is not necessary to confine yourself to the suggestions given. Any problems or methods associated with the above subjects will furnish interesting material. Descriptions of original methods will be especially acceptable.

October 1st will be the date of closing the contest, at which time all contributions must be in this office. Address letters plainly to Editor *Railway Engineering*, Manhattan Bldg., Chicago.

Non-Promotion of Deserving Men when Vacancies Occur.

A pernicious policy is that which will keep an experienced man on one job, which he is qualified to hold, and hire a new man to fill a higher or more important position, assuming, of course, that the man already working could fill the higher position. However, this is the position taken by a good many of our railway engineering departments. If a man is conscientious and is making good in a position, he surely has rights that should be respected. It is not fair for such a man to be ignored when better positions are to be filled. The man that is slighted in this manner has a legitimate grievance.

The argument seems to be that if you take one man away from a job and promote him, there will be two men to break in. The older man in the service has to be broken in on the new job, and the new man has to be broken in on the job formerly held by the older man. There is some force but nothing fair in this argument. The man who is filling the subordinate position, if he is progressive, has obtained enough experience and ideas concerning the practice and methods of the railway, to make it easy to instruct him in the new position. With the new man you are not only taking chances on his ability, but very likely he has ideas and methods that must be discarded before be can become efficient and work in harmony with the organization which is new to him. Then he must become acquainted with the general policy, as well as the detailed standards of the company.

A case in question occurred recently where a man was offered a responsible position on a railway. His experience would not qualify him to fulfill the position at all, and the offer was refused, the man not giving this reason for refusing, however. There were dozens of men in the department better qualified than the one to whom the offer was made.

We are often told that no man is indispensable. Why then refuse to promote a man because he understands his work? Another man will be found, and that easily, if an honest effort be made.

The great difficulty in following out a policy of always promoting a deserving man instead of hiring a new man is that the supply and demand for railway engineers is so extremely irregular. Sudden expansion of construction and location sometimes forces a railway to hire every available man. It may be possible at that time to obtain a large number of men who will accept the position of assistant engineers, but few who will work as instrument and rodmen. If the amount of construction was held to a reasonable and sufficient amount every year, there would be no such extraordinary demand, a permanent and more efficient force could be employed, and fairer treatment could be accorded employes. If a man fills his position satisfactorily and with the interest of the company at heart, he should be given every opportunity to advance. The opposite of this policy is tending toward a serious decrease in the efficiency and loyalty of employes.

The Northern Pacific is reported to be planning to let contracts shortly for a continuation of the Mandan-Stanton extension for a distance of about 40 miles.

The Tennessee Railroad has been organized in Tennessee with $10,000 capital to build from Iron City, Lawrence county, Tenn., northwest to Olivehill, Hardin county, about 40 miles. The incorporators are C. N. Brady, R. D. Baker, I. L. Pendleton, W. W. Collin and J. H. DeWitt.

PORT READING CREOSOTING PLANT.

The Port Reading Creosoting Plant, a joint property of the Philadelphia & Reading and the Central R. R. of New Jersey, is now in complete operation at Port Reading, N. J. It embodies the latest developments of the preservation of railroad ties and timber, and was constructed under the direction of Mr. William Hunter, chief engineer of the Philadelphia & Reading, with Mr. C. M. Taylor, superintendent of timber preservation, in direct charge.

The location of the plant at Port Reading is a very excellent one in that both railroads have direct connections to the plant and a deep water front affords facilities for the receipt of ties and lumber direct from the South, without any railroad haul after reaching Port Reading. It also permits the receipt of creosote oil in tank steamers from abroad and thereby does away with the delivery of oil in tank car lots. An eight inch pipe line connects the piers with the oil storage tanks.

The plant is divided into three divisions, namely, the tie and lumber storage yard, the power plant, impregnation building together with the storage tanks and saw and adzing mills, and lastly, the piers. The area of the ground allotted to the plant is sixty-seven acres; however, only about forty-seven are in actual use at the present time. The general plan of the plant is seen in figure 1. The yard is transversed by two narrow gauge ladders connecting with each track. This allows for the quick handling of tram cars to and from the tie yard.

The track arrangement in front of the cylinders is designed for the quick change of charges. The ordinary change of charges is made in about twelve minutes. The usual arrangement is to charge the ties from the north end of the cylinders and piling and lumber from the south end. Narrow gauge scales are located on the center track at both ends of the cylinders, to check up the volumetric readings. There is also a combination scale, forty-five feet long, on which both narrow and broad gauge cars may be weighed. The rail used is 80 pounds, and all the special track work is built according to the Reading standards.

The storage yard tracks are on seventy-five feet centers, and the approved height for piling ties is twenty-four. The capacity of the yard is 600,000 ties, four million feet of switch timber, and four million feet of lumber and piling. The yard layout is designed for additional storage capacity on the west side. The arrangement of tie piles is shown in figure 2. The apron effect in the piles comes from the fact that the ties are loaded onto the piles by means of the locomotive crane and the rear end of the crane swings over the apron. A distance of four feet is left between each tie pile. The piles are layed out east and west, as the prevailing wind is east and west. The ties are piled so that the alleys in every track correspond with each other, thereby increasing the wind circulation.

The site of the plant was formerly a swamp at an elavation of about + 3.0′ above mean high tide. The filling-in of this marsh aids two things. It first raises the ground level to approximately + 8.0′ and also made possible a deep water channel to the new piers 4 and 5. In all, there were about 250,000 cubic yards of sand and gravel pumped by hydraulic dredges from Staten Island Sound onto the swamp land. However, in many places the sand settled and about three thousand carloads of cinders and ashes were dumped on top of the sand. The result is a perfectly drained tie yard, which means quick and even seasoning of the ties and lumber.

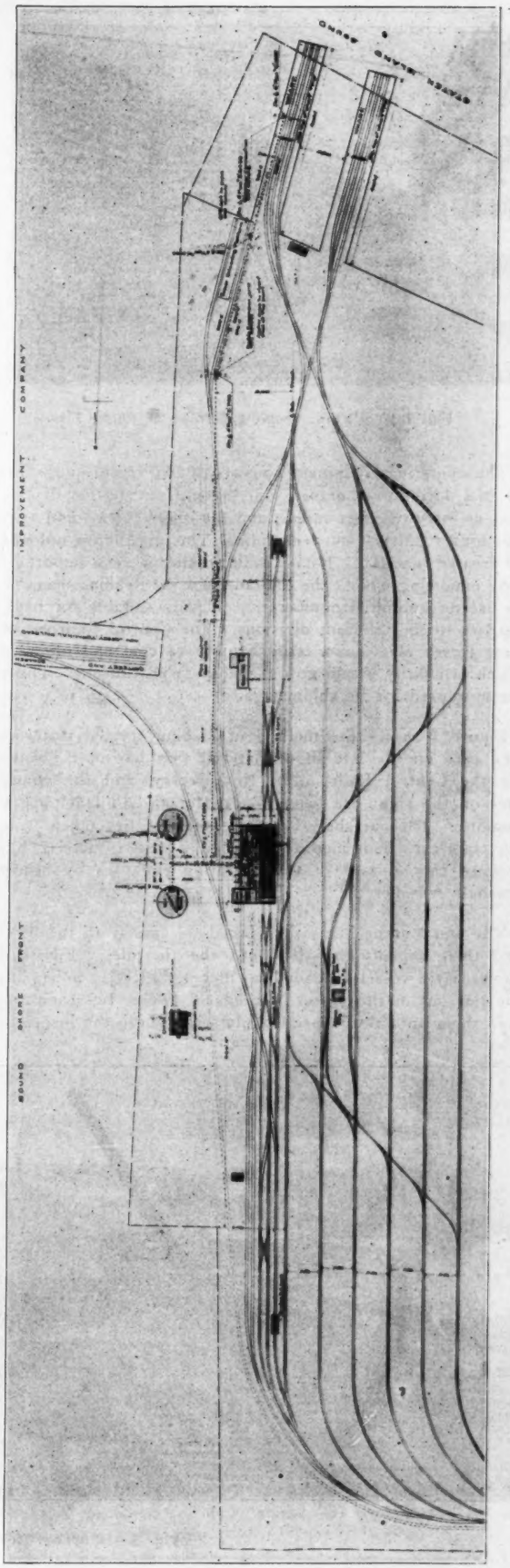


Fig. 1. Plan of Port Reading Plant and Tie Yard.

Fig. 2. Tie Yard, Showing Method of Piling Ties.

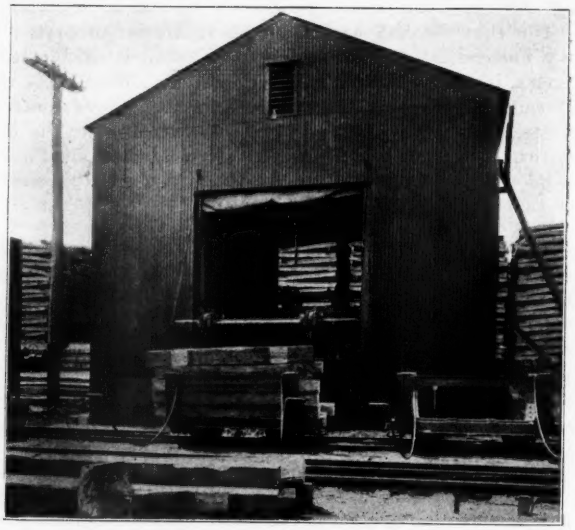


Fig. 5. Greenlee Bros. Adzing and Boring Machine.

The operating equipment consists of two broad gauge Industrial locomotive cranes, one having a capacity of five tons at forty-two feet radius, and the other of two and one-half tons at thirty-eight feet radius. The large crane unloads all treated material. Port Reading being a very important coal exporting point, the Philadelphia & Reading has for its use an unlimited number of coal cars suitable for hauling ties to the different divisions. The Central Railroad of New Jersey also has a large number of coal and ore cars which ordinarily would go out empty, from Chrome. These are now used for tie shipments.

Figure 3 shows the method of loading treated material. The cars on the left show material that has been loaded for the Central Railroad of New Jersey, and the empty cars on the right are being loaded for the Philadelphia & Reading. The cut shows a whole sling of ties taken from one tram car. This method of handling treated material has reduced this portion of the operating expenses by nearly one-half cent per tie.

The small crane hauls the special tie cars from the piers and then unloads the ties onto the tie piles. Figure 4 shows a tie vessel unloaded at Pier 4. Electric hoists lift the ties out of the vessel in slings of twelve ties each and land them onto the inspecting platform where the inspector examines each tie. The accepted ties are then loaded onto the special tie car shown in figure 4. When these cars are loaded, the little crane shifts them to the tie yard and unloads the ties onto the tie piles by means of slings put around the ties. About two hundred ties are loaded onto each car and the crane unloads these in six lifts. All that is then necessary is to spread the ties on the tie piles. This method of handling ties has decreased the cost to fifty per cent the cost of handling in the usual manner.

About seventy-five per cent of the ties come in by water. The other twenty-five per cent are line ties from the two railroads. The latter are inspected on the right of way, and then shipped to the plant; but the majority of the cars contain several different kinds of ties and each in different sizes. These cars are unloaded in any vacant space and a separation is made into six classes as follows: Class A, includes all the oaks; Class B, all the pines; Class C, beech, birch and maples; Class D, ash and hickory; Class E, gum; Class F, all ties not accepted for creosoting. These ties are then made up into slings and the little crane puts them onto their respective piles.

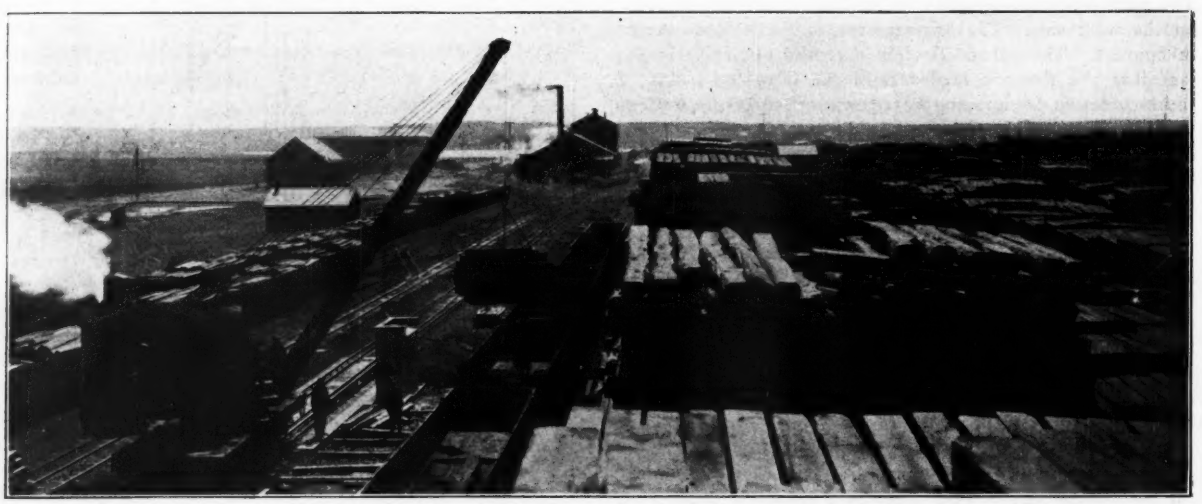


Fig. 3. Handling Ties with a Locomotive Crane.

For shifting the tie tram cars, there is a Vulcan narrow gauge locomotive, weighing twenty-seven tons. This is specially built for a creosoting plant and has curved bumpers on both ends. The tram car equipment consists of one hundred and eighty-four tie trams, and twelve bolster trucks for timbers and piling. The tie tram cars weigh 2,700 pounds each, and are especially built for the heavy service required of them. The wheels are equipped with Hyatt roller bearings and one man can move an empty tram with no difficulty, and two men handle a loaded tram with ease. The cars were built by the Orenstein-Arthur Koppel Co.

There are fifteen special tie cars for moving ties and lumber from piers to the tie yard. They are fitted with automatic couplers, and have removable stakes. Four by four oak strips are bolted to the top of the floor to allow slings to be placed around the ties.

cuts all the ties to exact length. This cutting of a small slice from each end of the tie does two things: (1) It shows absolutely whether the tie is sound through and through. No better argument to show that this should be done could be produced than the fact that there are ties thrown out on account of rot which otherwise did not show hidden defects until the ends had been sawed off. Of course, this sawing off of the ends is not possible when "S" irons are placed in the ends of the ties. Another reason for the sawing off of the ends is that you get better end penetration. In the seasoning of ties, there is always deposited on the ends thereof a hard, gummy substance, which clogs up the pores. Formerly in France, it was the custom to cut the ends off, to increase the end penetration.

The second function of the adzing machine is to adze plain surfaces at the rail bearing points. This saves all

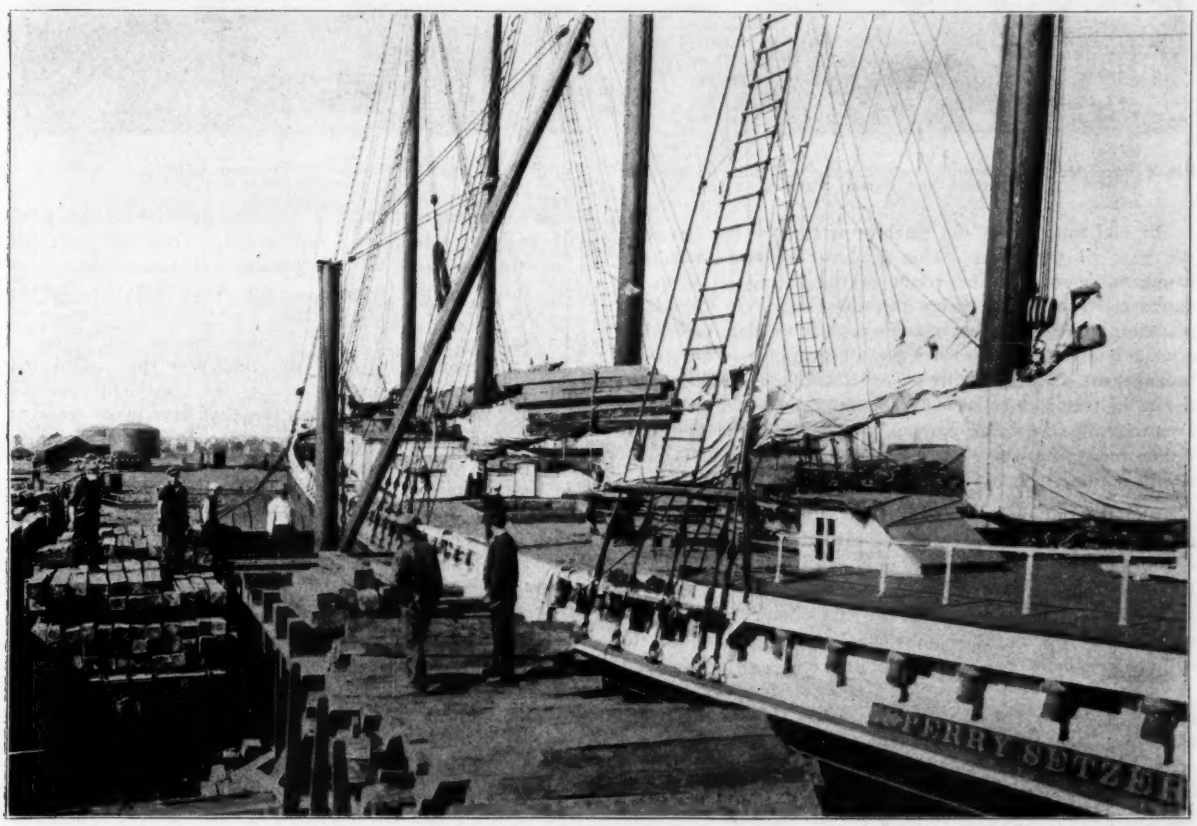


Fig. 4. Unloading Ties From a Tie Vessel.

The treatment of the ties begins by loading the ties onto the tram cars as shown in figure 2. The average tram load of pine ties is forty-five. The loading is done by piece work. In the case of pine ties, they are separated into "hearts" and "saps." All ties having 80 per cent of heart wood are called "hearts," and are loaded onto trams separate from the "saps." This insures uniform and regular treatment of all classes of pine ties. Sawn ties are separated from hewn, and the Virginia short leaf pine is kept separate from the other sap ties.

The loaded trams are then shifted to the tie adzing mill, shown in figure 5. There they are put through the tie adzing and boring machine. This is a Greenlee Bros. machine which performs admirably four functions: First, it adzing after the ties are treated, thereby saving the expense and delay of adzing while placing the ties into the track, and it also guarantees that no untreated heartwood will be exposed.

The third function is the boring of the holes for the spikes These holes are bored clear through the ties so that in case any of the holes are not used they will drain themselves. The boring of these holes is one of the most important steps in the preservative treatment of ties, in that it affords treatment at the point where the heavy treatment is required, namely, around the spike. The tie on the tram in figure 5 shows a tie bored for a 90 pound "B" section rail for the Philadelphia & Reading.

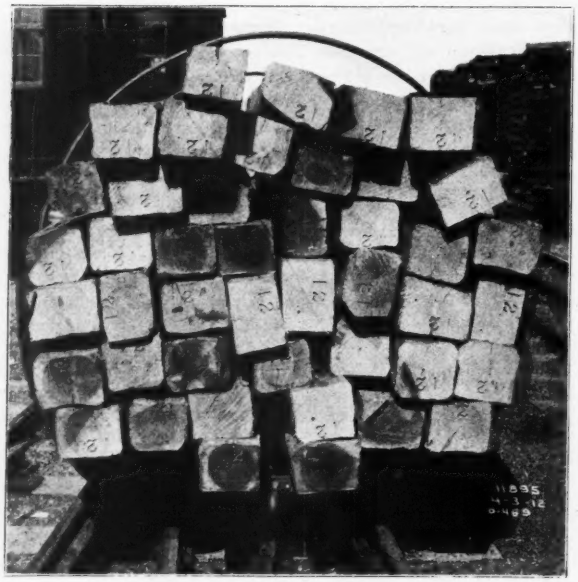


Fig. 6. Treated Ties, Showing Date Branded on Ends by Greenlee Bros. Adzing and Boring Machine.

Fig. 8. Interior of Treating Cylinder.

The last function of the machine is to date the ties with the year of treatment. This is done by two pneumatic hammers, opposed. The result of the dating is shown in figure 6. There have been objections made to this form of dating, presuming that the impression will not be visible after a few years. However, this objection does not carry, because the Central Railroad of New Jersey has treated ties in its track which were laid in 1876 and which are dated in identically the same manner, and the date is distinctly visible today, and the cost of dating in this manner is practically nothing.

From the tie adzing mill the tram cars are made up into trains of sixteen trams each and shifted to the impregnating cylinders, of which there are two, each 140 feet long by seven feet four inches inside diameter. Figure 7 shows both cylinders, one closed, and the other open with a charge of ties in it. Figure 8 shows the interior of one of the cylinders with the radiators uncovered, and both doors open. These cylinders are made of one and one-eighth inch steel with one and one-quarter inch rivets. They are built for a working pressure of 250 pounds per square inch, and were tested to 380 pounds. They were built by Reeves Brothers Co., of Alliance, Ohio, and shipped by them to Port Reading, each cylinder complete, except the doors.

The treatment of all ties and timber is that called the "full cell" or Bethel process, and is the treatment that has been used on all the timber and ties that have made creosoting the standard process of preserving timber. Cross ties are treated with ten pounds of oil per cubic foot, switch ties receive twelve pounds per cubic foot, framed bridge timbers also receive twelve pounds; unframed timbers are given fourteen pounds; piling, both red oak and pine, are treated so that all sapwood is penetrated. Wherever it is possible, all ties and timbers are seasoned before treatment; however, the cylinders are so equipped that when necessary, timbers and piling may be seasoned by steaming before treatment.

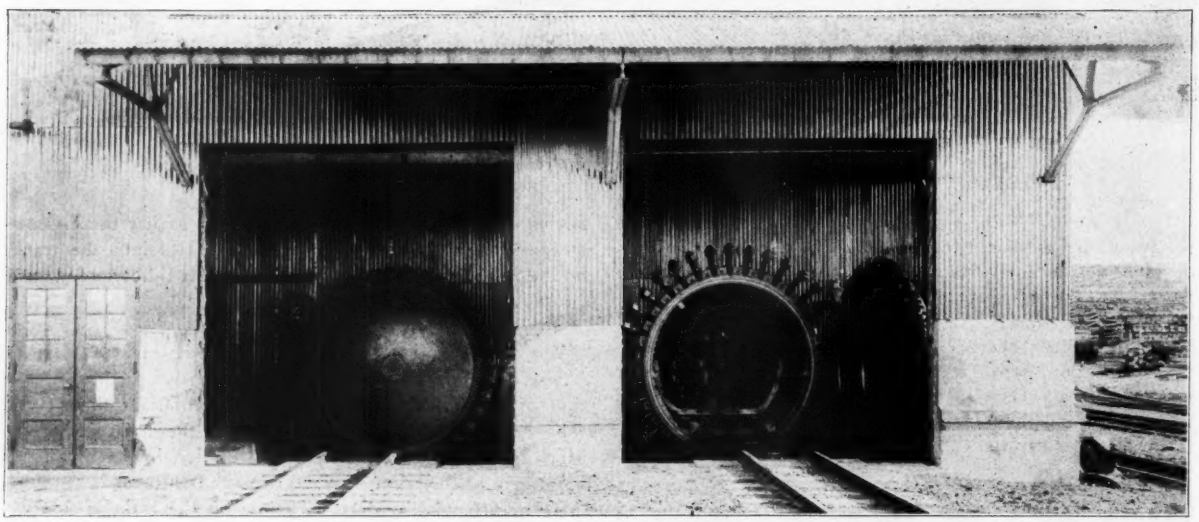


Fig. 7. North End of Impregnating Cylinders.

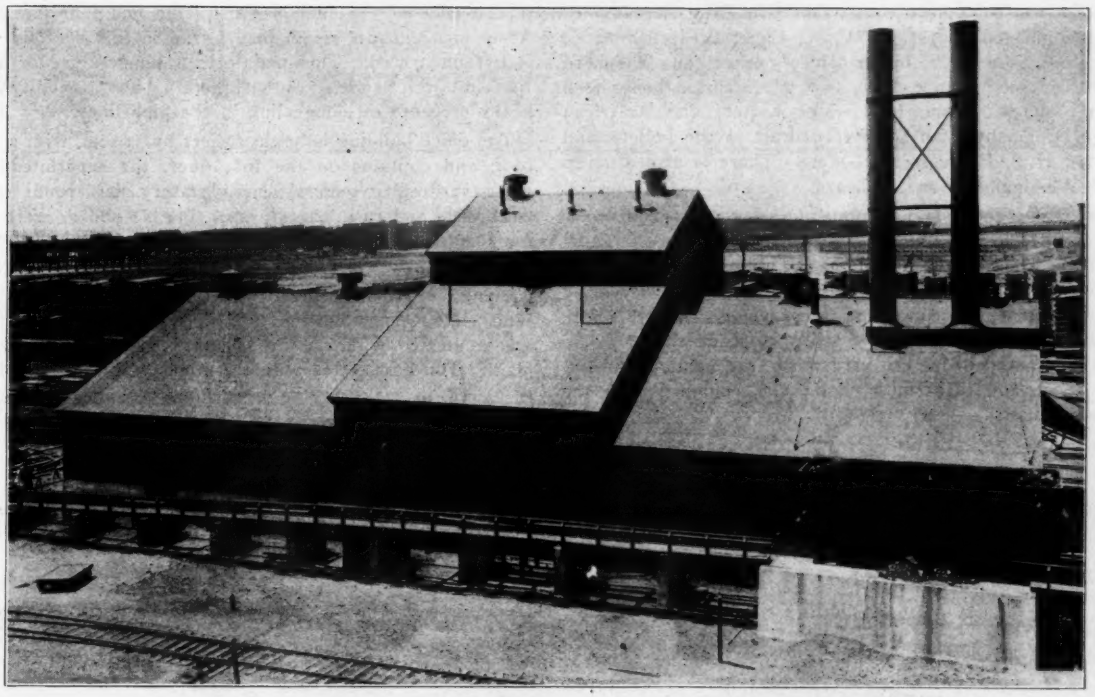


Fig. 9. Power Plant and Impregnating Building.

A saw mill has been installed to frame bridge and building material before treatment, wherever that is possible. There is no question but that there is a great increase in efficiency by having all material framed before treatment.

The power plant and impregnating building are shown in figure 9. It is a steel building with concrete foundations, one hundred and sixty-five feet long by seventy-two feet wide, with a coal pocket and approach on the east side.

The impregnating equipment consists of the two cylinders, four overhead working tanks, two measuring tanks, two Union Steam Pump Company's twin general service pumps, having a capacity of 1,000 gallons each per minute, two Dean Brothers' pot valve oil pressure pumps, one 700 feet-100 pound Ingersoll Rand air compressor, one 100 foot-250 pound compressor, one Union Steam Pump Company's dry vacuum pump fitted with a surface condenser, and hot well, together with the necessary recording pressure and vacuum gauges for each cylinder and tank.

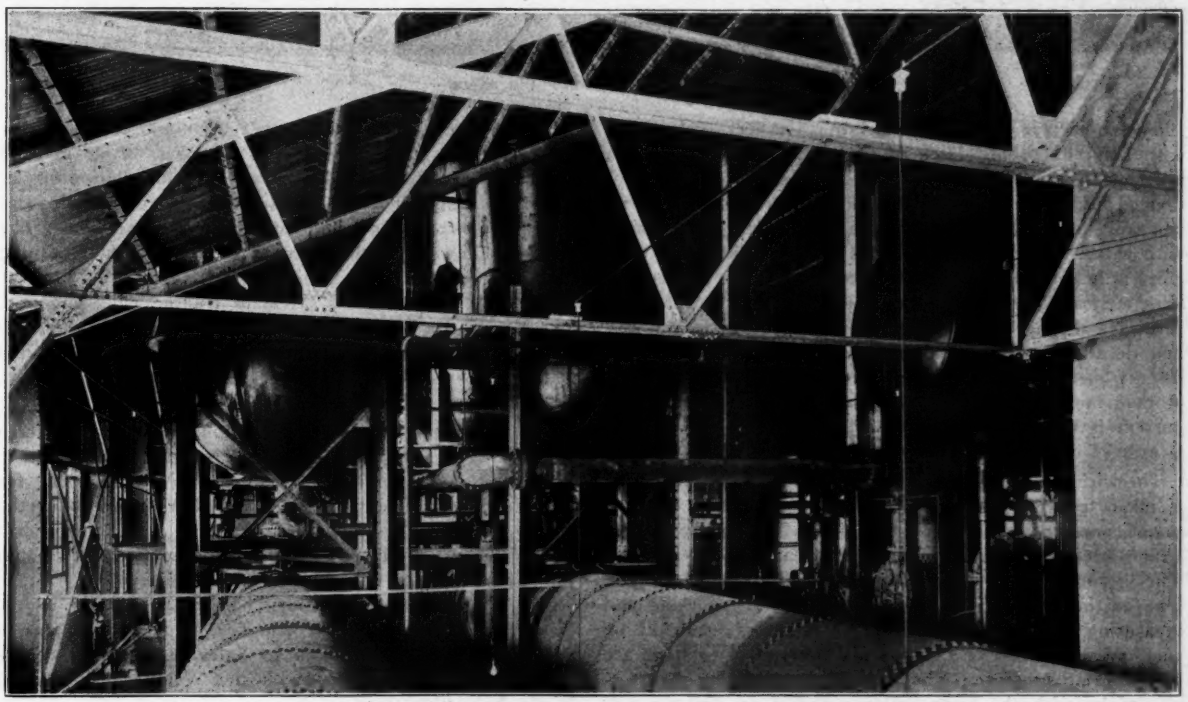


Fig. 10. Impregnating Cylinders, Measuring Tanks, and Machinery

The power equipment consists of two Erie City engines direct connected to 187 K. W. A., General Electric A. C. generators; one G. E. motor-driven exciter; one Shepherd vertical engine-driven exciter; two Worthington boiler feed pumps; one Cochrane feed water heater; one American Blower Company's fan for forced draft to the boilers, and two 250 H. P. Heine safety boilers. There is also a seven panel Westinghouse switch board.

The boiler room is partitioned off by a fireproof reinforced concrete partition and Underwriters' fire doors. There is also a stock room for lubricating oils and waste, packing, etc., and there is a machine shop fitted with necessary tools, including an automatic saw grinder, emery wheel, automatic knife grinder, lathe, drill press and shaper.

At the south end of the yard there is a combination engine house and blacksmith shop, fully equipped with the necessary tools.

Two tanks are provided for oil storage, each tank being sixty-five feet in diameter and thirty-five feet high, fitted with umbrella roofs. Each of these tanks is fitted with a mile of heating coils, each tank having its own system divided into four sections. All the oil tanks, both the storage tanks and those in the impregnating building, are heated with exhaust steam, and there has been absolutely no difficulty in heating the storage tanks to 150 degrees Fahrenheit, with a steam pressure of three pounds. The power plant furnishes the necessary current for the motors in the saw and tie adzing mills and for the Williamson electric hoists on the piers, and for the pumping of the water into the storage tanks on Hogg Hill. The cost of generating this current is low, for all the exhaust steam from the engines is utilized in the heating coils in the various oil tanks.

The wiring is all installed in conduit, and every precaution is taken to avoid fire. All the oil piping is fitted with 250 pound pressure fittings and the oil valves are the special Crane creosote valves, fitted with cleaning out pockets. The steam piping is fitted throughout with welded flanges. The heating coils in the cylinders and in the working and measuring tanks are specially made radiators furnished by the American Radiator Co., and are guaranteed to stand 250 lbs. working pressure. The pipe lines connecting the storage tanks with the main building are in an underground reinforced concrete duct, five feet high and four feet wide. A six inch exhaust steam pipe is run in this duct too, and is left uncovered. This maintains a temperature of about 100° into the tunnel, so that there is no possibility of a heavy creosote oil congealing in the pipe lines.

The office building is brick, 40 feet by 41 feet, with a slate roof, and contains on the first floor, the superintendent's office, yard office, general office, lavatory, dark room, chemist's office and two laboratories. The second floor is used for a lunch room and stationery.

The buildings, piers and tie storage yard are splendidly equipped with fire protection. There are two fifty thousand gallon tanks on top of Hogg Hill, and these tanks are connected with the fire system throughout the whole plant. The hose, fitted with the Jones automatic couplings, is placed in racks in the hose houses, which are located throughout the storage yard, and in and about the buildings.

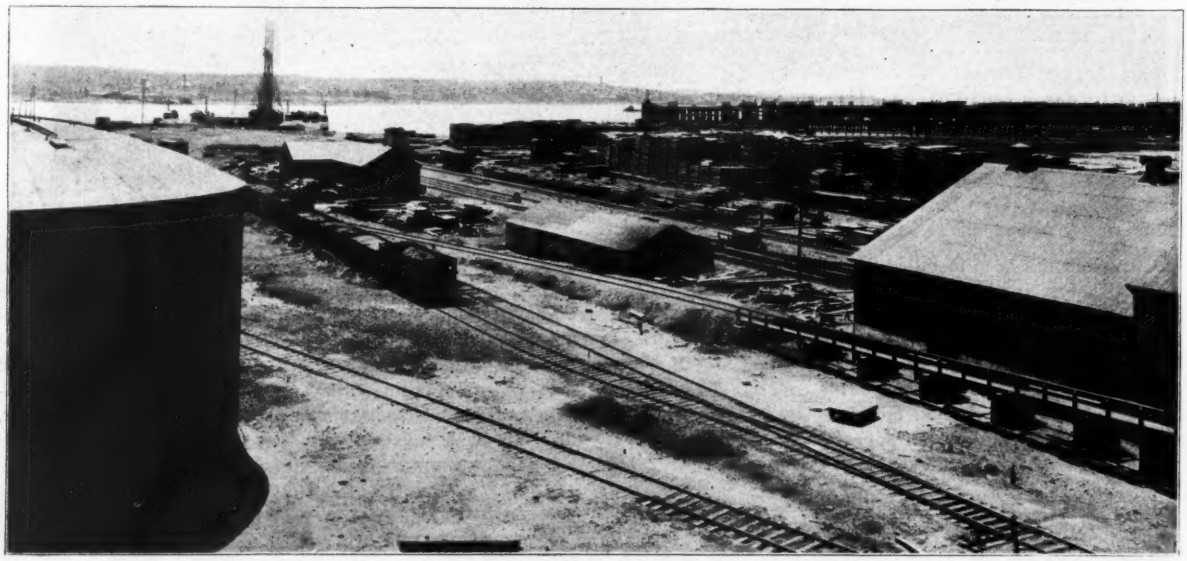


Fig. 11. South Yard and Piers.

The piers and all concrete construction was put in by the railroad's own forces under the engineer of docks and wharfs, Mr. Frederick Jasperson. The installation of all the machinery, boilers, oil and steam piping was carried out under the direction of the motive power department. The steel buildings were built under contract with McClintic Marshall Construction Company.

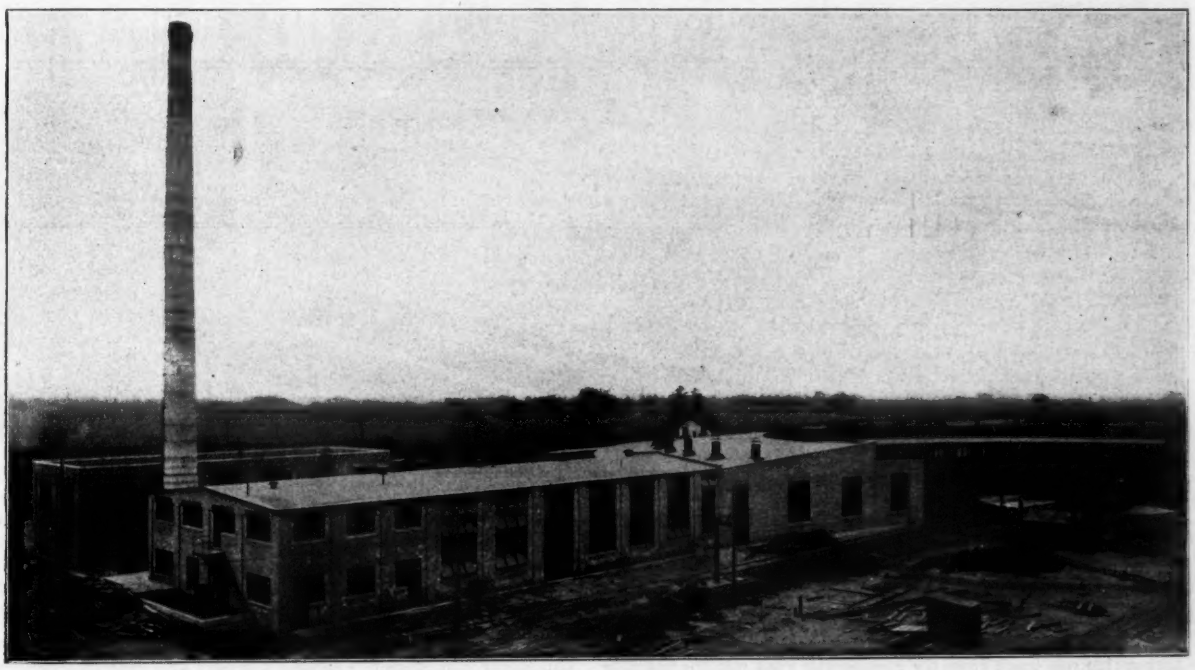
We are indebted to Mr. William Hunter, chief engineer, and Mr. C. M. Taylor, superintendent of timber preservation, for the information and illustrations presented in this article.

The Fort Smith, Arkona & Wilburton, a new line, by which the Missouri, Kansas & Texas will secure an entrance to Fort Smith, has purchased 42 acres at Arkona, Okla., for yard facilities. The road will enter Fort Smith over the Frisco tracks. The Fort Smith, Arkona & Wilburton will run to Wilburton, Okla., and will open an entirely new country. At Wilburton it connects with the Katy.

The Gulf, Texas & Western has let a contract to the Texas Building Co., Fort Worth, Tex., to build an extension from Jacksboro, Tex., south to Saleville, 23 miles, where connection is to be made with the Weatherford, Mineral Wells & Northwestern.

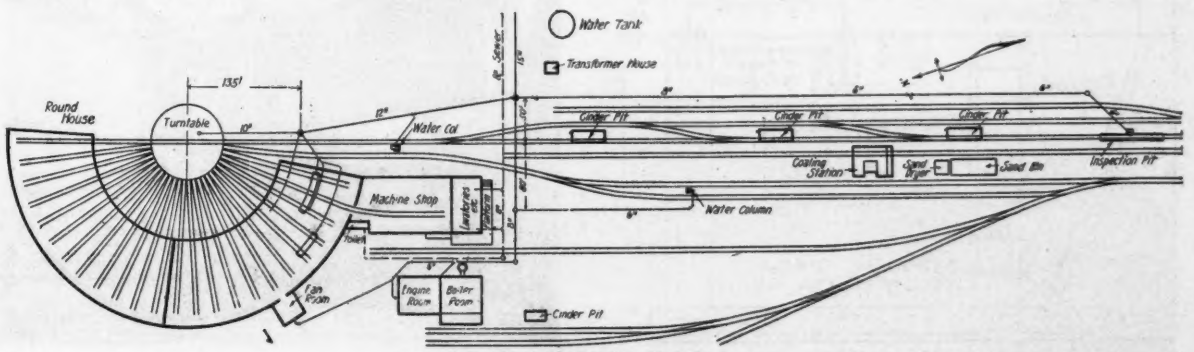
Champaign Terminal.

The Illinois Central has just completed a terminal at Champaign, Ill., which together with the classification yards being completed at Centralia, will greatly facilitate the movement of freight bound for Chicago. Centralia is 251 miles south of Chicago on the main line to the Gulf and here freight bound for Chicago or for points west is classified and made up. Champaign is 126 miles south, on the main line and is a mid-way division point between Chicago and Centralia. The old terminal at Champaign was in the city, near the business section and therefore located on valuable ground and its future development was limited. So it was decided to build a new terminal, and for this purpose a tract of land two and a half miles north of the city was purchased at a reasonable price, which it has been estimated will amply provide for all needs for at least twenty-five years to come. The project just completed represents only about one-sixth of the development which is possible at this point.

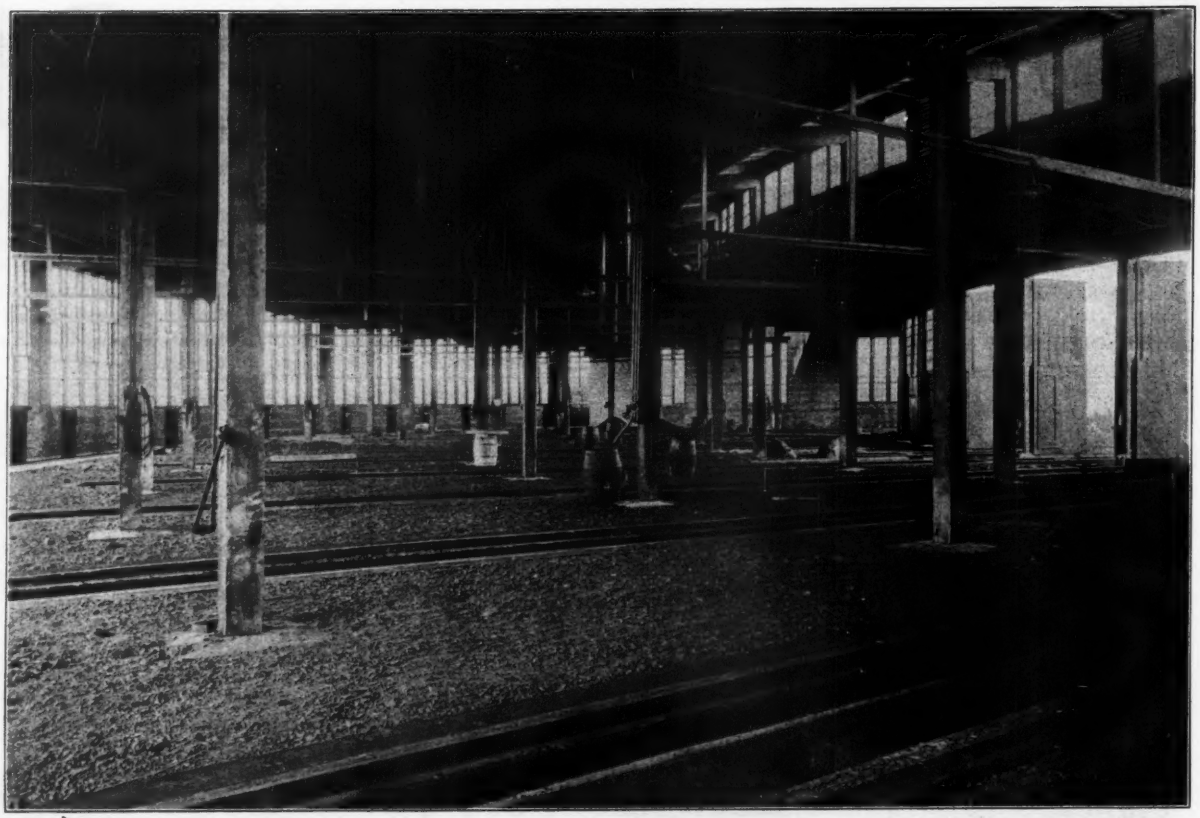


General View of Champaign Terminal.

The new Champaign terminal includes a 24-stall roundhouse, machine shop, store room, power house, coaling station and cinder pits. The radii of the inner and outer circles of the roundhouse are respectively 111 ft., 5¾ in. and 212 ft. The footing walls are of a 1-3-6 concrete mixture and are designed for a pressure on the soil of 4,000 pounds per square foot. All timbers used in pit construction are creosoted and at present a cinder floor is being used in the roundhouse, the plan being to put in a brick floor in about a year when the foundations will have settled. As may be seen in the layout drawing, there are three driver pits and two truck pits, both truck and driver pits being served by 3,000-pound capacity jib cranes equipped with chain hoists. Posts are 10 in. x 10 in. and 12 in. x 12 in., with 10 in. x 16 in. girders, and the roof is 5-ply tar and felt laid on 1¼-in. plank. The 24-stall house is divided into two sections by a 13-in. fire wall having a fire door at each end. Adjacent to the outer circle and opposite stall eight is a fan house 29 ft. x 27 ft. containing the fan which draws the air over heating coils and forces it into the heating duct which runs around near the outside circle, with openings into each of the roundhouse pits. Paul Dickinson cast iron smoke jacks



Layout of Champaign Terminal.



Interior of Champaign Roundhouse.

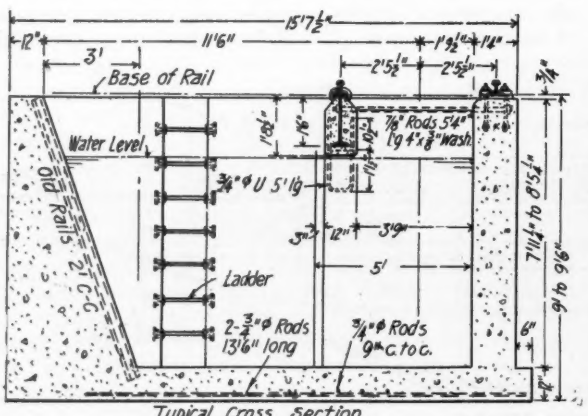
are used, and the boiler washing system was installed by the F. W. Miller Heating Co., of Chicago.

At one end of the roundhouse and joining it, is the machine shop, about 65 ft. x 110 ft., containing also the offices of the foreman and the boiler inspector, together with a tool room, toilet room and engineers' register room. It will be noted in the layout that one track from the roundhouse runs into the machine shop. The shop is well equipped for light repairs, the following being the list of machine tools installed:

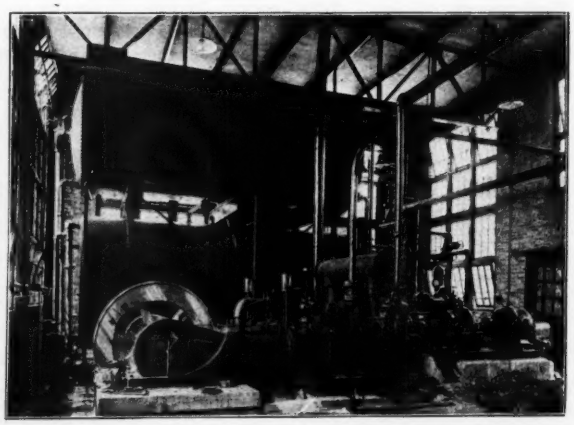
Acme Bolt Cutter,
Barnes 42-in. vertical drill,
Schumacher & Boye 22-in. engine lathe,
Ryerson sensitive drill,
Niles-Bement-Pond 36-in. engine lathe,
Cincinnati 20-in. shaper,
Safety double emery grinder,
30 in. x 30 in. x 10 ft. Niles-Bement-Pond planer.

The storeroom is a two-story addition at one end of the machine shop, and is 36 ft. x 65 ft. At one end of the lower story of the addition, are the offices of the road foreman of engines, general foreman and clerks; at the other end are located seven oil pumps which were installed by the Fort Wayne Oil Pump & Tank Co., of Fort Wayne, Ind., while in the center is the storeroom proper. Outside, a cinder and cement platform surrounds the building on two sides. In the upper story is a locker room containing 218 12 in. x 12 in. x 36 in. double tiered lockers with expanded metal doors. Here also is a toilet room with showers and a commodious engineers' lounging room. These latter facilities are instances of the way in which a modern railroad treats its employees.

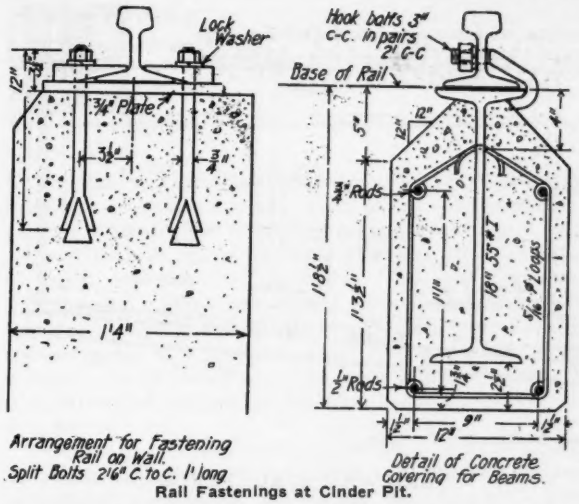
Nearby is the power house, a brick building with steel roof trusses, the roof being composed of concrete slabs which are



Cross Section Through Cinder Pit, Champaign Terminal.



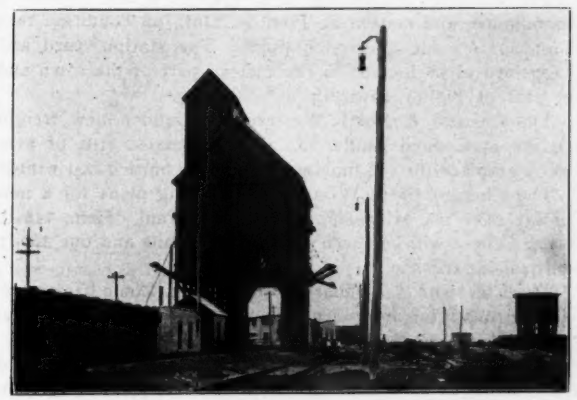
Miller Washout System in Power House (Note Concrete Roof).



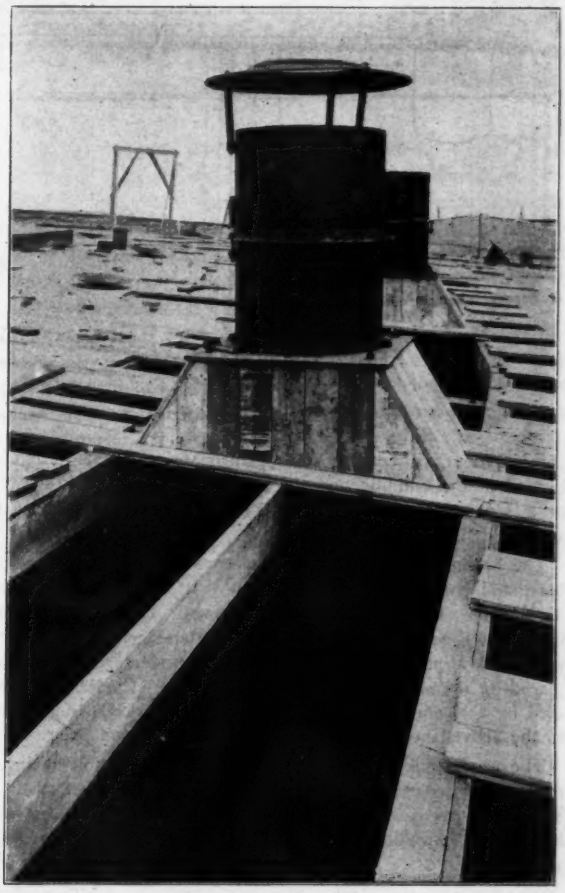
Arrangement for Fastening Rail on Wall. Split Bolts 2'6" c. to c. 1' long

Detail of Concrete Covering for Beams.

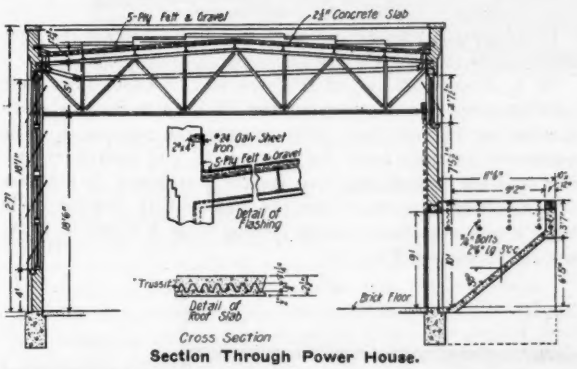
Rail Fastenings at Cinder Pit.



Snow Coaling Station.

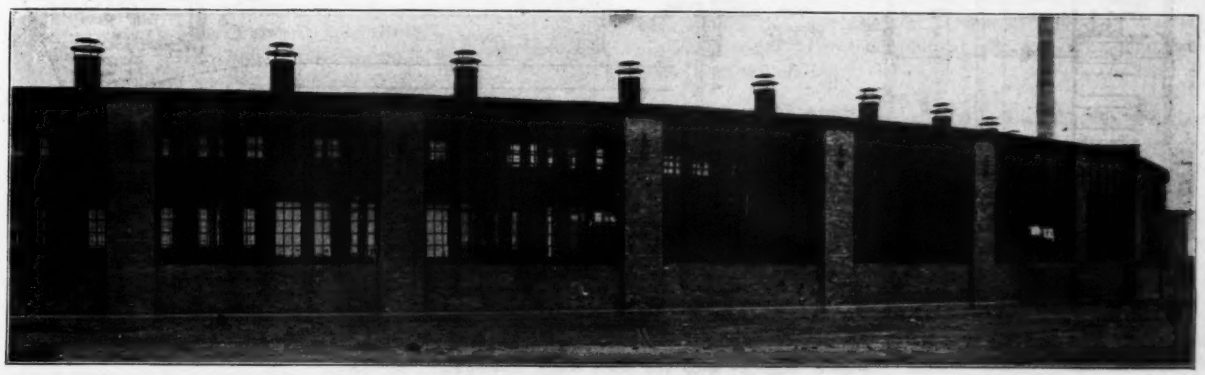


Construction of Smoke Jacks.

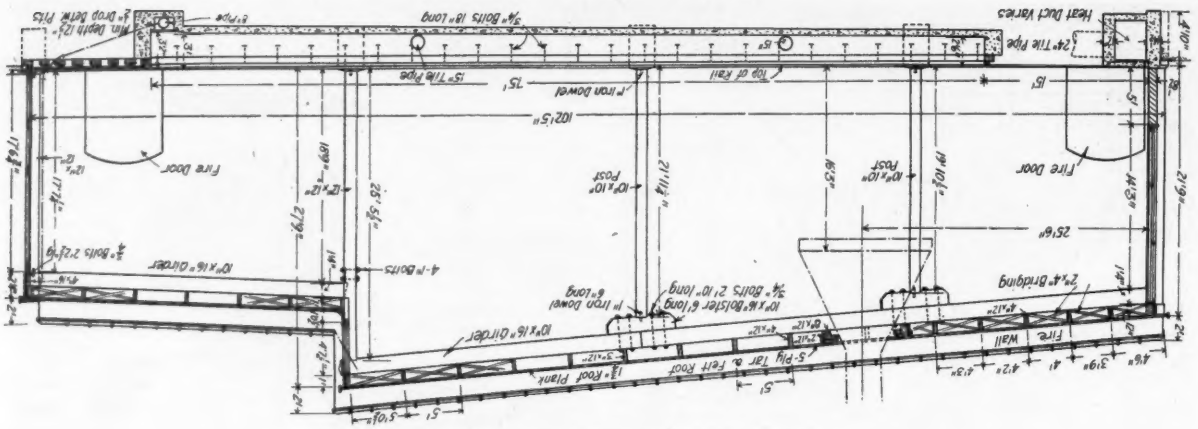


Section Through Power House.

quite thin, their average thickness being about 2½ in., and are covered with 5-ply felt and gravel roofing. Concrete is used as a flooring. The coal bunkers are of concrete, built through the wall at one side, discharging directly in the power house and have a capacity of 175 tons. The chimney which is of reinforced concrete, was built by the Weber Chimney Co., is 153 ft. in height, with a diameter of 5 ft. at the top and 10 ft. at the bottom and rests on a 20-ft. concrete base. The power house is equipped with three 72 in. x 18 in. Chandler & Taylor horizontal tubular boilers having a total horsepower of 450. They are equipped with Burke stokers and Blake-Knowles open type feed water heater. There is also a 1,000 gallons per minute Allis-Chalmers centrifugal fire pump and a 1,000 cu. ft. Laidlaw-



Showing Ample Provision for Light, Champaign Roundhouse.



Section Through Roundhouse, Champaign Terminal.

Dunn-Gordon air compressor. A distributing switch board is located in the building and the primary transformer is located in a separate house outside. The Miller washout system is also located in the power house.

The coaling station is of wooden construction, on a concrete base, and has a capacity of 600 tons. It was installed by the T. W. Snow Construction Co., of Chicago. The cinder pits are of concrete composed of one part Portland cement, 2½ parts sand and 5 parts stone. To protect the sides, old rails are placed on the slope, laid on two-foot centers. Cinders are handled by a locomotive crane, and clam shell bucket. In addition to the above, there is an inspection pit and a sand drier.

The water tank is of standard wooden construction having a capacity of 100,000 gallons. The water supply is furnished by eight 10-in. wells having a depth of from 165 to 172 ft. Power house and the roundhouse pits are connected to a 15-in. drainage sewer laid on a 1¼ per cent grade, leading to the drainage ditch. Manholes are placed at convenient intervals. The sanitary sewers are a separate system having 8-in. and 6-in. pipe and leading to the septic tank which is 8 ft. x 20 ft. x 8 ft. The yard is lighted by 16 arc lights and in accordance with up-to-date practice tungsten lights are used in power house, roundhouse and machine shop. In the roundhouse 250-watt tungstens are used, three being placed between pits; in the power house 150 watt tungstens are used and the machine shop is supplied with Benjamin clusters holding five 40-watt tungstens. The construction work on this project was done by Westinghouse-Church-Kerr & Co., under the supervision of the Engineering Department of the Illinois Central R. R. to whom we are indebted for the above information.

RAILWAY STRUCTURES.

The Canadian Pacific has been granted a free site for a roundhouse and station at Trenton, Ont., on condition that Trenton is made a division point. The station, yard and shops are to be located in the eastern part of the town and in part of Sidney township.

The Chicago & North Western will build a new freight station at Council Bluffs, Ia., at an estimated cost of $42,000, to replace the old building which was burned last winter.

The Chicago Great Western is preparing plans for a new bridge over the Mississippi river at St. Paul, Minn., 742 ft. long. There will be seven plate girder spans and one 190-ft. vertical lift truss span.

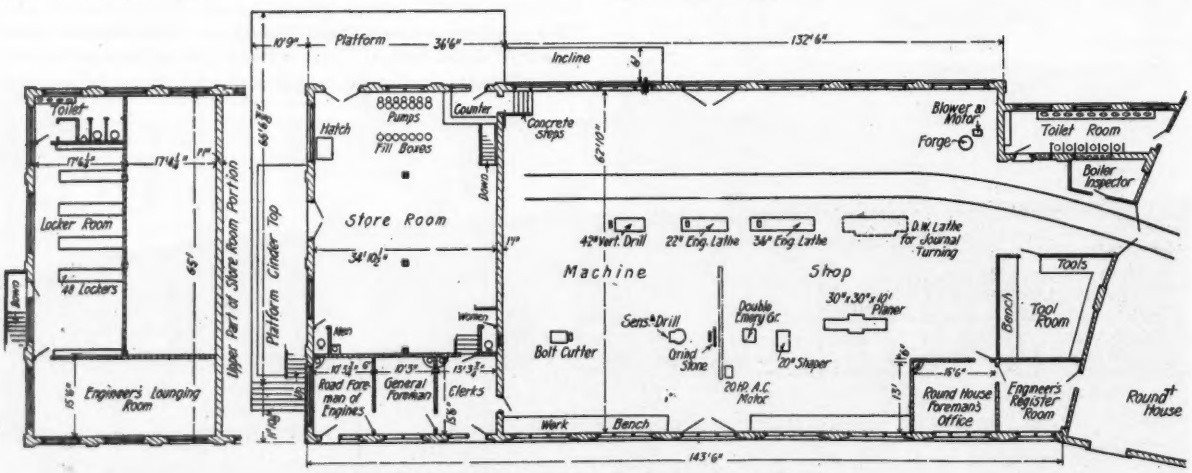
The Cleveland, Cincinnati, Chicago & St. Louis has awarded contracts for improvements to its shops and yards at Bellefontaine, O., at an estimated cost of $178,000.

Improvements costing about $10,000,000 on the Denver & Rio Grande, which have been contemplated for a long time, will begin immediately. The first contracts will call for the construction of a second main-line track from Castle Gate to Kyune, Utah.

It is said that the Gulf Line will build a brick passenger station at Hawkinsville, Ga.

W. L. Pearson & Co., of Houston and El Paso, Tex., have been awarded the contract for the El Paso & Southwestern stations at Tucson, Ariz., both freight and passenger. The estimated contract price for the freight and passenger station and the roundhouse and freight warehouse is $125,000.

It has been announced that the Kansas City Southern will build a new passenger station costing from $125,000 to $150,000 at Texarkana, Tex.



Plan of Machine Shop and Store Room, Champaign Terminal.

San Bernardino Precooling Plant

By C. M. Gay.

Precooling as relates to transportation is a term frequently misunderstood and misapplied. There is but little general experience in the art, and it has been confounded with cold storage and methods applied to static conditions from ignorance of its real application and significance. That it should appear as a complete, practical and efficient system applied to a whole trainload of loaded cars, with only the precursor of a few sporadic experiments applied to single cars, is a tribute to the invention, careful design and engineering ability shown in the construction and operation of the great plant which this article describes.

It would hardly be necessary to elaborate upon the design, construction or operation of any cooling plant which by ordinary methods of refrigeration reduces the temperature of fruit or other products placed in refrigerating rooms for that purpose. All the conditions relating to such methods of refrigeration or cold storage are matters of common engineering knowledge and practice. But since the advent of precooling as a separate and distinct application of refrigeration to transportation has been recognized as an accomplished fact, it has become the fashion to dignify the old time cold storage process with the title of precooling plants, to escape the unpleasant inference and historical associations connected with cold storage proper, where the conditions are best suited to holding goods for a market rather than expediting delivery of goods to the market in the shortest time and best condition.

The term "precooling," properly applied, relates primarily to transportation and the immediate cooling of products within the refrigerator cars without re-handling and entirely apart from the idea of refrigerating by cold storage under ordinary practice.

There is no element of novelty in the cooling of perishable products in rooms where the ultimate object may be either that of reduction of temperature only or the indefinite holding for an advanced market. This is a cooling and cold storage function entirely within the discretion and control of the grower or shipper performed upon his own premises with no direct relation to transportation or transportation conditions.

On the other hand, precooling being performed within the refrigerator cars themselves eliminates all question of cold storage or holding goods for market, and by virtue of the fact that it is so performed necessitates speed, eliminating every factor of delay as a prime requisite of successful operation, *and therefore logically becomes a function which is a prerogative of the transportation companies, in the same manner that cold storage before delivery to the railway company is an unquestioned prerogative of the shipper.*

The element of time involved in the operation of precooling being one of prime importance in accelerating the movement and availability of refrigerator cars and equipment, furnishes a factor that fits exactly with the requirements of quick and efficient arrest of deterioration and decay in the fruit or other perishable products handled.

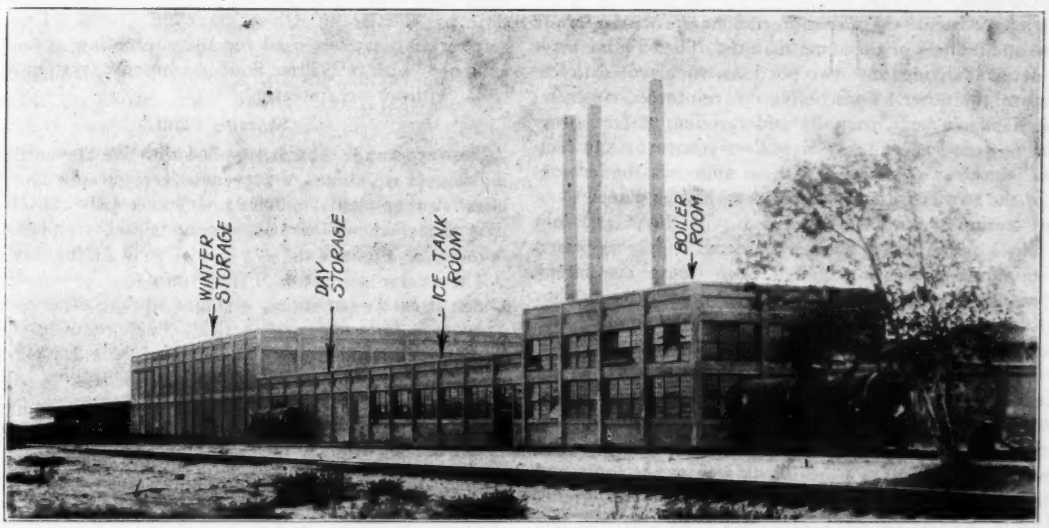


Fig. 1.—View of Plant at San Bernardino.

The concrete advantages of precooling may be summarized as follows:

Quick reduction of temperature to a safe point for transportation purposes.

Elimination of decay and deterioration.

Reduction of number of stops and switches for re-icing en transit.

Shortening of time schedules between producer and market

Avoidance of re-handling to and from storage.

Extension of market by lengthened radius of safe shipment.

Granting the desirability from the standpoint of both shipper and carrier of securing these advantages above enumerated, we are brought to consideration of adequate precooling equipment, cost and efficiency.

Santa Fe Plant.

Located in the center of the citrus fruit district, the Santa Fe plant has been in continuous service since its erection, early in 1910. Pick-up trains are operating throughout the entire San Bernardino valley, are taken to the precooling station as fast as loaded, and after a delay of about four hours, proceed to their Eastern destinations. Only occasional subsequent icing, filling the car bunkers, is needed en route.

General Plan.

The general arrangement of the plant is shown in Fig. 2, and an exterior view is shown in Fig. 1. The main building, comprising the power plant, tank room, day

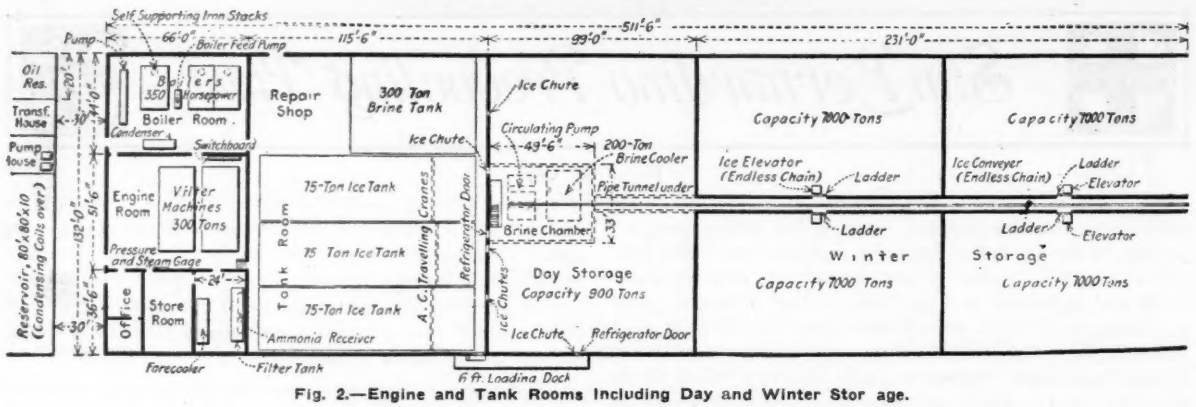


Fig. 2.—Engine and Tank Rooms Including Day and Winter Stor age.

storage and winter storage, is 511 feet 6 inches long by 132 feet wide. Connecting to the winter storage, the precooler chamber and icing dock extend for a distance of 737 feet 6 inches, the icing dock proper being 693 feet long. This gives a full length of 1249 feet for the plant, or approximately one-fourth of a mile.

The structure is entirely of reinforced concrete with interior partitions and tunnels of the same material. The building may be considered as divided into two portions, one devoted to ice manufacture, the other to precooling. A reinforced concrete reservoir has been built, partially underground, 30 feet away from the powerhouse end. It is 80 feet square by 110 feet deep and is used in connection with an ammonia-condensing system of the two-coil double pipe type, which is placed over the front section of the basin coincident with the plant. Adjoining this a pump house has been erected supplying water for the ammonia condensing system, consisting of two circulating pumps, one steam and the other electrically driven. There is a transformer station on a line with the pump house, and a crude oil tank, 20x30x10 feet, has been constructed similar to the water reservoir and parallel to the boiler room.

Water for the system, including ice manufacture, is obtained from an artesian well, which is connected to the reservoir by a 14-inch steel pipe line. This is at the surface of the ground at the well end, and enters a measuring weir at the basin end approximately 4 inches below the edge of the reservoir, giving a gradient of but one per cent. The flow from this well furnishes a supply of 500 gallons per minute, the normal flow being increased to this extent by an air lift, for which pupose a 4-inch air line is placed in the same trench with the water line. The air compressors for this system are located in the boiler room.

Ice Manufacturing Plant.

The installation comprises three 350-horsepower Sterling boilers, set two in a battery and one single. These furnish steam to two 24x42-inch cross compound Vilter Corliss engines, each direct connected to one 300-ton, 17x34-inch duplex double-acting Vilter refrigerating machine. Adjacent to the engine room is a 36x24-foot forecooler tank, filters and ammonia receivers, the latter being placed under the filtering apparatus.

The tank chamber is 115 feet 6 inches long, and extends across the full width of the building, having a ceiling height of 21 feet, with the floor line below grade the distance noted. The floor is of concrete, covered with 2-inch corkboard over which there is a finish of 1½ inch asphalt. Three 75-ton ice-making tanks are here installed, giving a total capacity of 225 tons. The cans used are of the regulation size, 11x22x44 inches, forming 300-pound blocks, and are handled three at a time by electrically driven traveling cranes. One 300-ton refrigerating tank is used for the precooling system and is equipped with a Vilter flooded-ammonia system of brine coils, with an accumulator.

Storage Plant.

The day storage room is supplied with five Stevenson recording double ice chutes, a Stevenson refrigerator door and the usual storage-plant auxiliaries. It has a daily capacity of 900 tons of ice, when blocks of 300 pounds each are placed on end in one tier. Figure 9 shows a typical view of the day storage.

The winter storage is divided into four compartments by 6-inch concrete partitions, giving a storage capacity of about 7,000 tons for each such section. Each room in the winter storage is provided with an endless chain ice elevator for storing and having an iron ladder for access.

Adjacent to the wall separating the tank room and day storage, and below the floor of the latter, is a 49x33x11-foot brine chamber which is shown in the sectional elevation, Fig. 3. This compartment contains a 200-ton, two-coil, double pipe brine cooler and three electrically driven circulating pumps. The latter are interchangeable, two being used for the storage plant, or two for the precooling system, as the conditions necessitate; by this arrangement it was possible to omit a fourth pumping unit.

A concrete tunnel 8 feet wide leading from this cooling chamber extends through both storage rooms. At the end of the winter storage, the tunnel becomes a double-deck structure, the added section being of like size and construction as the lower duct, as will be noticed in Fig. 5. This lower tunnel is used for the brine mains running to the winter storage, and to the precooler coil chamber; the upper portion gives access to the winter storage and carries an endless-chain ice conveyor which leads from and through the day storage.

The entire storage plant, including the brine chamber, is insulated with 1½ inch double "Nonpareil" corkboard, with an asphalt finish of 1½ inches thick on the floors. The roof is

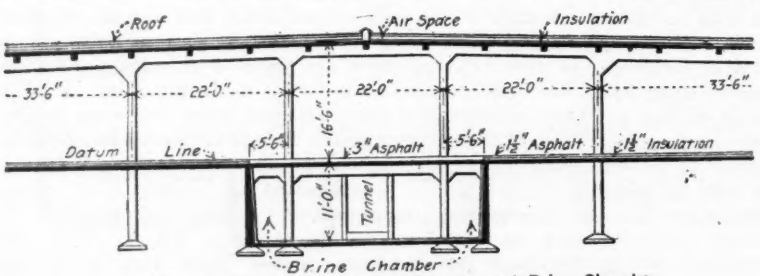


Fig. 3.—Section through Day Storage and Brine Chamber.

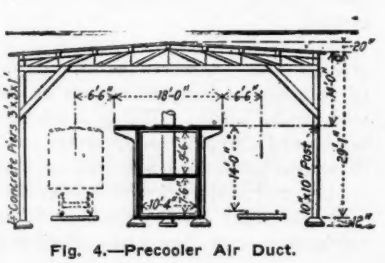
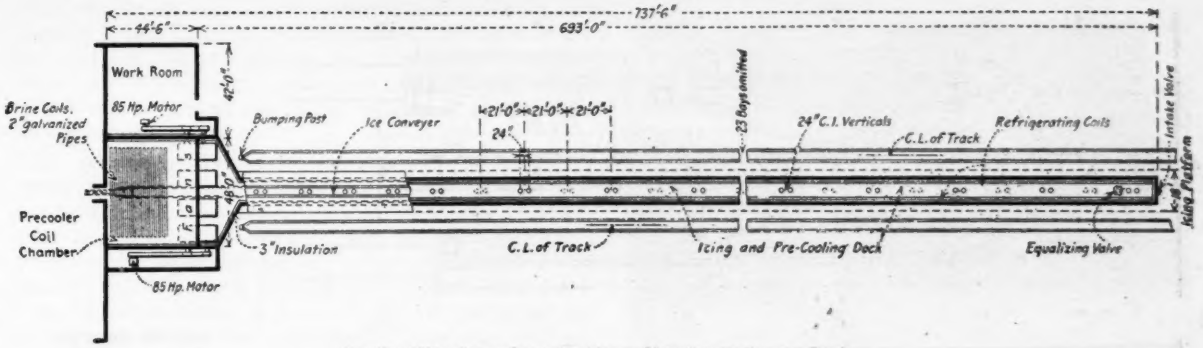


Fig. 4.—Precooler Air Duct.



Continuation from Opposite Page, Showing Coils and Dock.

insulated with "Linofelt" and air spaces. Neither room has any outside openings, all ice being handled through the day chamber and the central tunnel in the winter-storage room.

Precooling Plant.

The combined ice-making and precooling plant of the Santa Fe Railroad at San Bernardino, California, was designed and constructed under the direct supervision of Mr. C. M. Gay, of Los Angeles, California, and the precooling department was constructed under his patents with the advantages of careful engineering tests and data derived from his operation of the Santa Fe Experimental Station, where only one car at a time was treated.

The early experiments so conducted by Mr. Gay proved conclusively many engineering facts in regard to the condition of refrigerating cars and equipment, upon which were based inventions and devices peculiar to the system finally adopted. One fact stood out prominently, that all refrigerator cars were far from being air tight. Upon testing the cars after closing them as tightly as possible with an air pressure equivalent to one-half inch water gage, they showed a loss of air from unseen openings from 800 to 2,000 feet per minute, and an equivalent vacuum within the car produced practically the same result in the amount of air drawn in from the outside. Consequently, in order to perform the function of precooling in an efficient manner and without great loss of refrigerating capacity, it was highly necessary that exactly as much air be withdrawn from the car as was being forced into it in the process of cold air circulation, and that the air circulating system must be so balanced, that the point of equalization between the pressure coming from the main pressure air ducts and the suction established in the main return ducts should occur as nearly as possible in the center of the car.

With this preliminary explanation a better understanding will be had of the following description and accompanying cuts.

Precooler Coil Chamber and Icing Dock.

Connected by the concrete tunnels, the precooler coil chamber adjoins the winter storage. It is 44 feet 6 inches long by 48 feet wide and is insulated with 3-inch corkboard. The installation consists of a brine coil of 2-inch galvanized pipe, supported by 4-inch channel uprights and small angle brackets riveted thereto. Eight double-inlet Sirocco fans, each about 10 feet in diameter, are arranged in two banks of four each. A set of four fans, two upper and two lower on each side, is driven by an 85-horsepower motor. One bank is used for blowing, while the other is for exhausting, each function being capable of execution by either set without reversing the direction of rotation. A horizontal concrete baffle, literally a floor, is placed between the two banks, as shown in Fig. 6.

Leading from the precooler chamber, two longitudinal concrete tunnels or air ducts extend to form the main support of the car-icing dock. These are 7 feet 6 inches and 9 feet 6 inches high respectively, and 10 feet 4 inches wide; both are of the same length, containing the full length (693 feet), of the icing dock. The lower tunnel is the pressure duct, and the upper the vacuum duct, both being internally insulated with 3-inch corkboard. Refrigerating coils of 1¼-inch galvanized iron brine pipe are arranged on both sides of either duct, a total length of about 50,000 feet being required.

Connecting to these sections by liquid-sealed revolving joints, No. 18 galvanized iron pipes 22 inches internal diameter, serve as laterals to couple the system to the refrigerator cars. This is shown in Fig. 7, which affords a view of the icing dock arrangement. Figure 10 gives a view of the car icing dock which is additional to the precooling dock for icing of cars.

Electric System.

Purchasing electric current at high voltage from a central station, and stepping down to a voltage suitable for operation, the electric system offers no particular departure from ordinary practice; that is, the electrical energy is obtained at 10,000 volts and is reduced to 440 volts for motor operation, and again to 110 volts for a three-wire lighting system. The alternation of steam-driven and electrically driven auxiliary machinery, as previously indicated, permits of a continuance of operation should trouble occur at the central station.

Operation.

The plant has a maximum precooling capacity of 32 cars, 16 on either side of the icing dock, in every four hours, or approximately 150 cars every 24 hours.

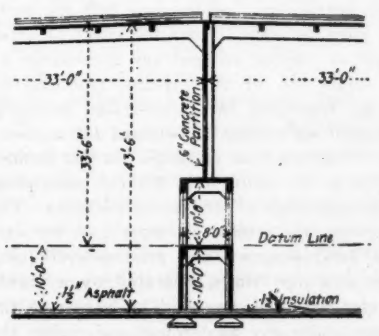


Fig. 5.—Section through Winter Storage.

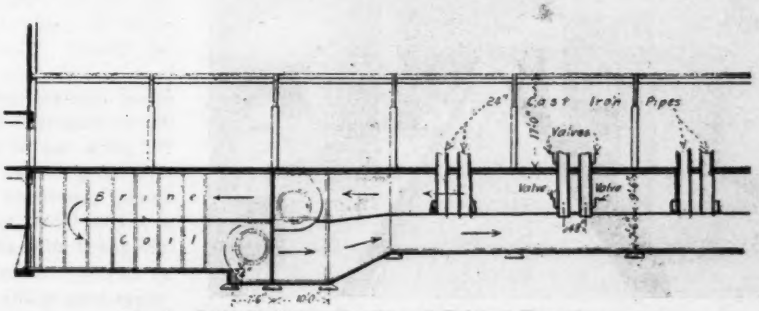


Fig. 6. Baffle Between Supply and Exhaust Tunnels.

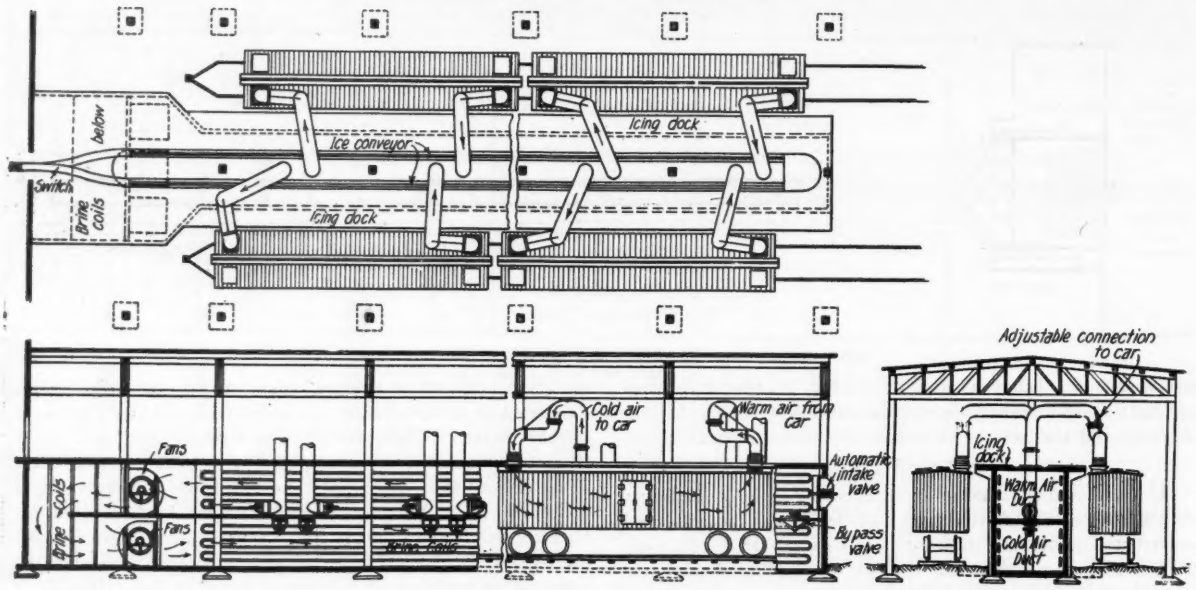


Fig. 7—Layout of a Gay Precooling System.

The brine is taken from the ice tanks by the circulating pumps in the brine chamber beneath the day storage, sent through its refrigerating circuit and returned to be cooled by the brine coils in the same compartment. By this refrigeration of the main ducts, the circulating air is kept in a similar state throughout its entire movement except when passing through the lateral connections to and from the cars.

A large automatic equalizing valve connecting the pressure and vacuum ducts is placed near the terminals of the tunnels. By regulation of this valve the pressure of the air delivered to the cars, and the suction at which it is withdrawn, are positively governed. The opening of this valve forms a by-pass whenever the differential pressure becomes excessive, thus permitting the air to circulate through the main ducts and main cooling chamber even when no connections are made for precooling.

An automatic intake valve is located at the extreme outer end of the vacuum or low pressure duct, as noted on the plan, Fig. 2, for the replacement of air which may be lost from the system by blowing the warm air from the cars. This is regulated to open when the vacuum falls below the differential pressure at which the equalizing valve is adjusted. The fresh air so taken into the system travels the full length of the suction duct, through the precooler coil chamber, and is then delivered to the high pressure duct to be distributed through the cars.

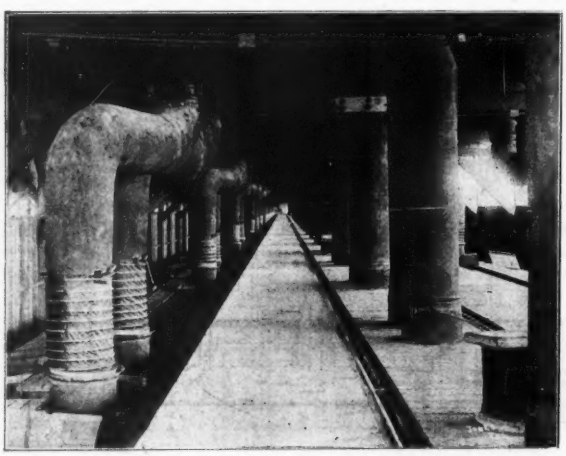


Fig. 8—View of Precooling Dock and 22-Inch Air Pipes.

This insures the proper cooling of all air brought into the system from outside sources during the operation.

Referring to the fan installation, the upper bank is used for exhaust from the low pressure duct, delivering the air to the precooler coil chamber and thence over the brine coils. The other set draws the air from the coil chamber and discharges into the lower or main pressure duct for circulation through the system. The total air so handled is about 260,000 cubic feet per minute. The lower duct is held at a pressure corresponding to from ½ to ¾ inch of water above the atmosphere and the upper at a vacuum of ½ to ¾ inch of water. Accordingly, the air is supplied to the former at a temperature of from 8 to 10 degrees, and is returned through the latter at a temperature vaying from 20 to 24 degrees.

The fundamental principle of the Gay system is to secure a balanced circuit with the pressure above atmosphere in the pressure duct, practically equivalent at all times to the vacuum below atmosphere in the return on the suction duct. By this method a balanced differential air pressure directly at the ducts is obtained without the overcoming of any frictional resistance in the coil chamber. The point of equalization of the air current is thus rendered practically in the center of the refrigerator car whenever such connections may be made. Tests at the plant show that the differential pressures so equally balance during precooling as to allow the opening of the refrigerator doors, in the center of each side of the car, without any apparent loss of air to the outside, or the bringing in of any warm air, although a current of from 6000 to 8000 cubic feet per minute of cold air is passing through the cars.

Valves fitted to each lateral pipe, opening into both the pressure and the vacuum ducts as noted, secure the effect of cross connection and reversal of current, without any interchange of the laterals. These valves are of circular-disk type and of heavy construction. By employing the liquid-sealed revolving joints, universal horizontal adjustment is obtained for connecting the laterals to the refrigerator car openings. In this manner the union can be made to an entire train without uncoupling or spotting of cars, and regardless of their various lengths. The closing connection between the lateral air pipes and the cars is accomplished by a bellows spring and scissors-lever joint, comprised of leather and iron rings, operated by a crank, as may be seen by reference to Figure 8. This preserves the entire area of the pipe under any adjustment and makes the connection air tight almost instantly. The pipes themselves

are absolutely air tight, being externally insulated with two layers of ¾-inch hair felt, suitably covered. By means of the universal joints they swing free of the car track when disconnected. No telescope connections are employed in this system and no internal valves, the valves used being visible for constant inspection.

In connecting the cars in practice, a funnel is placed over the bunker opening and the pressure air duct is first connected to the car for about 20 seconds. The cold air rushing in quickly displaces the warm air and vapors which are allowed to escape through the ice bunker trap door at the opposite end. The lateral from the suction duct is then joined to the ice-bunker opening at this end of the car, and circulation is established. During the cooler seasons of the year both connections are made simultaneously. The differential pressures, of course, control the speed with which the air passes; the violence of the current permeates to the center of every package, which is an essential consideration in proper precooling.

The total amount of refrigeration consumed by a car of fruit averages about 3 tons, depending upon the initial temperature of the fruit, which, varying with the season of the year, may cause this amount to become as low as 1½ tons or as high as 4 tons of refrigeration. The amount of air circulating through each car in a period of four hours approximates 1½ million cubic feet. When the plant is running at maximum capacity the amount of air circulated through each car per minute is about 8,000 cubic feet, with an average loss not exceeding 5 per cent. The cars are cooled to about 40 degrees Fahrenheit.

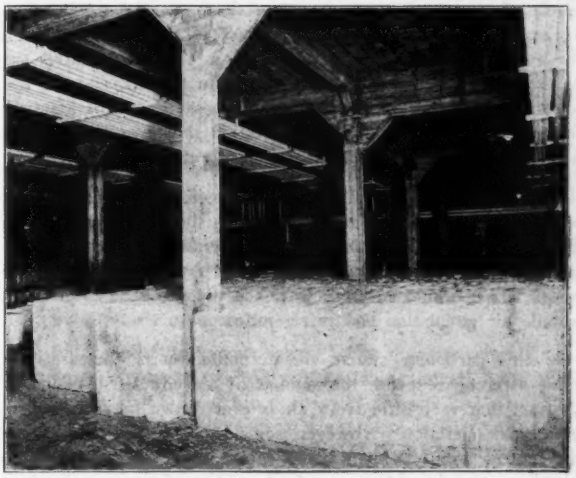


Fig. 9—View in Day Storage Room.

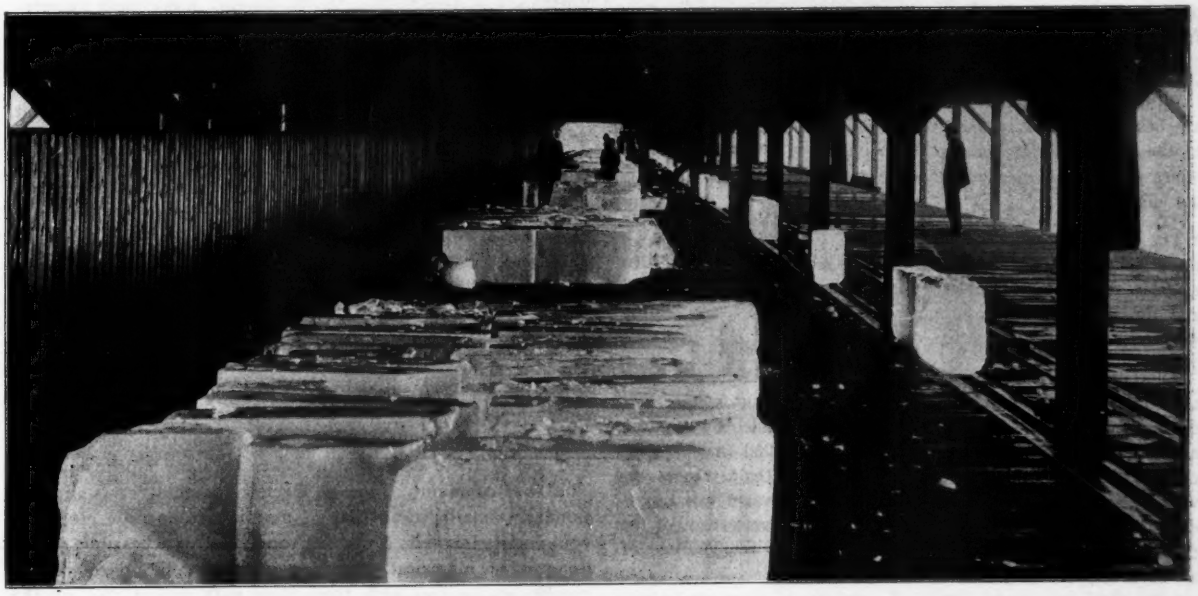
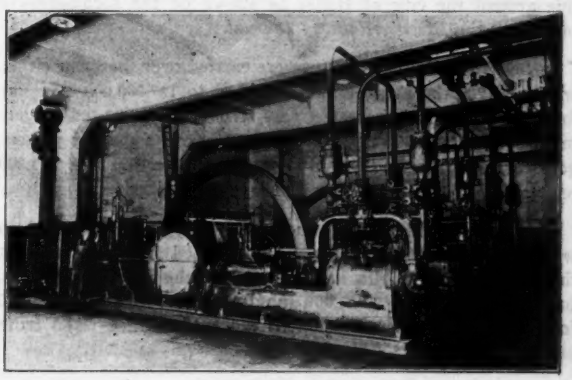


Fig. 10—View of Car Icing Deck, San Bernardino Plant.

For icing the cars, upon the completion of precooling, or for such cars as are not precooled, the ice is handled by the endless-chain conveyor running through the day and winter storage. Here it may be diverted or carried on to the dock, the conveyor traversing the full length on both sides and making the ice accessible for immediate loading.

The plant is provided with facilities for metering all the brine used in precooling, and in cooling the ice-storage chambers, also with thermometers giving the temperatures at all such places. Barometric columns are installed in the main air ducts and laterals, showing the pressure at which the air is circulated and returned. To afford a complete refrigerating record on every car handled, the velocity of air in both feed and return laterals is measured.

A brine system of refrigeration has its advantages in precooling work. During the period of changing trains and other intermissions the plant is given an opportunity to store up cold brine, placing it in a position to properly handle the large refrigerating demands made when a full load is incurred. The original charge of ammonia at the Santa Fe plant was about 13,000 pounds and during its period of operation this has been added to but slightly.



Engine Room, San Bernardino Plant.

The plant represents an investment of about $900,000. The special features of the system installed are the combination of an ice-making and precooling plant in the same structure, the avoidance of loss of refrigerated air either by leaking out of the car, or by drawing outside air into the car, and the application to one or more cars at the same time with identical treatment, with the addition of effecting the precooling service without any alterations in the standard refrigerator car.

A feature of the operation of this system is the facility with which the cooling pipes are defrosted in the precooling system. The large quantities of humid air withdrawn from the cars in circulation results in an accumulation of frost upon the cooling pipes, which would in time frost the pipes together, so as to impede air circulation and refrigeration.

In this particular system the accumulation is comparatively slow, as compared with the amount of air circulated, owing to the fact that very little fresh air is ever drawn into the system in normal operation. However, some small degree of evaporation comes from the fruit itself in the short process of rapid air circulation in addition to the humidity of the contained air in the different cars, and in actual practice it is found advisable to defrost the coils at least once a week. This is accomplished by stopping the brine circulation and opening up four or five air laterals from the discharge or pressure duct to the outer atmosphere, when the great automatic equalizing valve will open under the suction from the fans, drawing the warm air from the outside, passing it over the coils and out of the discharge laterals.

With the brine circulation stopped and the warm external air being passed over the frosted coils and discharged again to the outside, it is found that one hour to one and one-half hours will completely remove the frost from the pipes and freezing surfaces.

The sewer connections, which are charged with calcium in the sewer trap, are then opened and the melted frost discharged at once to the sewer, after which the connections are closed and the cooling pipes are ready for another week's operation without requiring defrosting.

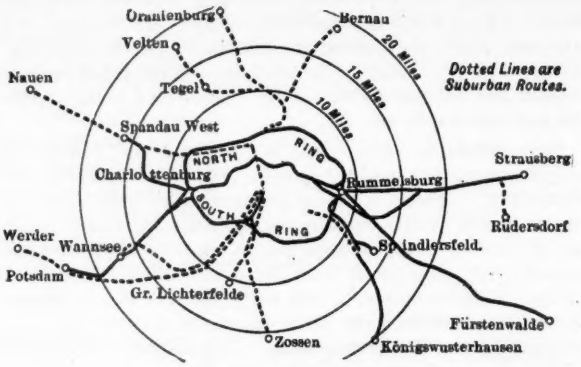
Another feature of the Gay patents is the arrangement for utilizing the precooling connections as preheating connections during severe cold weather. These are not installed or required at the San Bernardino plant, but will be installed in such precooling plants as are located where the winter temperatures are very severe, operating the cooling pipes with warm brine, producing a higher temperature of air to be circulated through the cars in exactly the same manner that the low temperature of air secures precooling.

ELECTRIFICATION OF BERLIN STADTBAHN.

The electrification of the Berlin Stadtbahn is projected by the Railway Ministry of Germany. This system is a suburban line around the city of Berlin as shown on the accompanying map from the *Electric Railway Journal.*

In 1895 75,000,000 passengers were carried over the inner circle, while in 1909 the number had increased to 157,000,000. In like manner the suburban traffic rose from 41,000,000 passengers in 1895 to 137,000,000 in 1909. The average number of passengers carried daily in 1909 on the suburban section was 341,300 on weekdays and 784,000 on Sundays and holidays.

Some idea of the probable increase in carrying capacity which will be required in the future may be gained from the fact that the population of Berlin itself, served by the inner circle lines, has increased from 2,017,000 inhabitants in 1895 to 2,898,000 in 1909, while the population of the suburbs has risen from 382,000 in 1895 to 807,000 in 1909.



Map of Berlin Stadtbahn.

The carrying capacity of the Stadtbahn is already insufficient for the requirements. Of three suggested remedies for the deficiency, namely, doubling the existing track and station facilities, building new underground railways and installing an entirely new system of urban and suburban railways, all have been proved to be impracticable on account of engineering and financial difficulties. Under present steam conditions, it is not possible to operate more than twenty-four trains an hour in each direction, each train having a seating capacity of 488 passengers. The minimum service which will meet the requirements of 1916 would be rendered by thirty trains an hour, each seating 610 passengers, but it is necessary to provide for further increases and to allow for at least forty trains an hour in each direction. As it is impracticable to increase the length of the trains and to use two steam locomotives for each, the only possible solution is electrification.

After electrification had been decided upon, there still remained the choice between locomotives and multiple-unit motor cars. Electric locomotives, according to the report, have many advantages. Two or more can be connected to each train and operated by one man, by a simplified multiple-unit system; they are less destructive to the permanent way than either steam locomotives or electric motor cars, and one of them can take the place of many motor coaches. The cost of maintenance of electric locomotives is proportionately smaller than that of motor cars and the electrical equipment is well protected and easily accessible. The amount of electrical energy consumed will, under similar conditions, be less with them than with motor cars, as the efficiency of the large locomotive motors is higher than that of the more numerous and smaller motors necessary with motor cars. The total weight of the locomotive motor is spring-borne so that there is no noise or vibration from any motors on the passenger cars to inconvenience the passengers. A further important consideration, according to the report, is that by the employment of electric locomotives the very large amount of existing rolling stock can be retained.

The electric trains at the hours of heaviest traffic will consist of thirteen six-wheel coaches, propelled by two electric locomotives, one in front and one at the rear. During slack periods groups of five cars or eight cars will be hauled by one locomotive. By fitting the end passenger coach with a controller it will be possible to control and drive the shorter trains from either end. The maximum length train, consisting of thirteen cars and two locomotives, will weigh 355.5 metric tons.

CHICKASHA TERMINAL.

What is probably one of the finest and most completely equipped station buildings in Oklahoma is that of the new terminal for the Oklahoma Central Railway, located at Chickasha, Okla., which at present is the western terminus of the road.

The building measures 52x110 ft. and is at present two stories in height. It is constructed of a reinforced concrete skeleton, veneered with brick, and other fireproof materials. The lower floor is used for passenger traffic, baggage and express purposes, while the upper floor houses the officials of the road. The lower floor is a 4-inch concrete slab resting on a cinder fill, with a mosaic tile or concrete top finish.

The construction varies slightly from the usual concrete type, inasmuch as the wall columns have been omitted and the slabs are carried on the walls, a uniform bearing of 4 ins. being given for the slabs and 8 ins. for the beams. The latter rest upon reinforced concrete seats, not less than 4 ft. in length, and 8 ins. thick by an average depth of 21 ins.

orated with an ornamental plaster cornice running around the entire room.

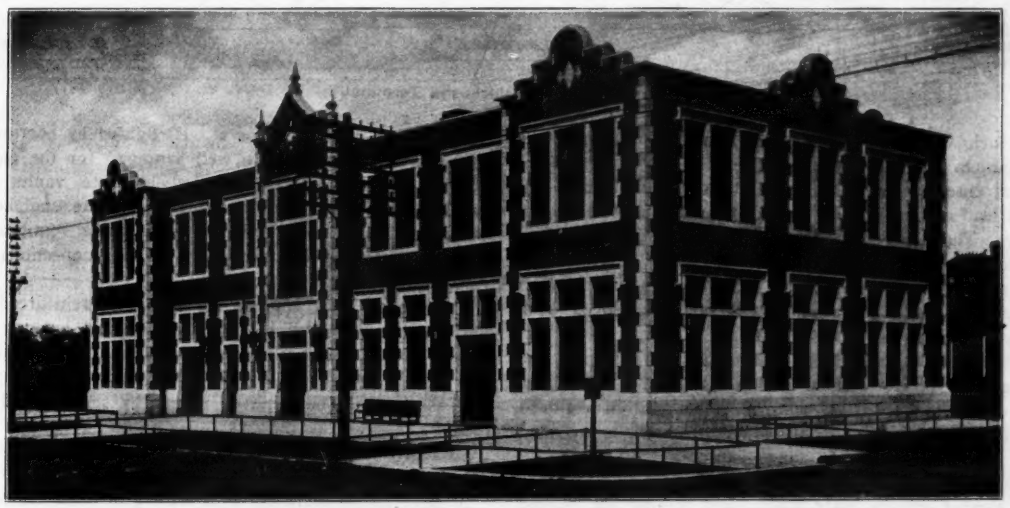
A tile wainscot, 7 ft. 6 ins. high, of Ludowici promenade tile, laid in the basket weave pattern, makes an attractive and durable wall surface, and the floor of this room is covered with the same material. The corridor connecting the waiting room and entrance lobby are floored with promenade tile.

The ticket office is floored with maple, but except for this, all rooms on the first floor have either tile, mosaic, or cement floors.

The gentlemen's toilet is lighted with both borrowed and artificial light, and perfect ventilation is assured by an electric exhaust fan placed at the mouth of the vent duct near the ceiling, which connects to the vent shaft.

All toilet stalls throughout are of white domestic marble, the floors to toilets are of white marble mosaic, and all wood trim in toilets is finished in white enamel. Closets are of white enamel finish, so that the general appearance is neat and clean.

The steam mains are entrenched around the first floor, and



Station Building, Chickasha Terminal.

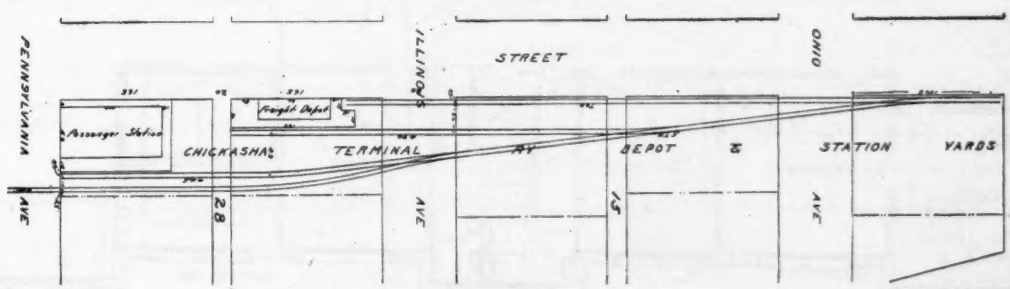
The lower walls are 17 ins. thick, built of extra hard burnt brick laid in pure cement mortar, while the upper walls are 13 ins. thick of the same material. The two end walls are each stiffened with two 17-in. piers.

The floors are 6½ ins. thick, with an average span of 18 ft. and are designed for a live load of 100 lbs. per square foot. The face brick is a deep rich red, and the trimmings are of Algonite, a pure white artificial stone. The design is English and makes a most attractive looking building.

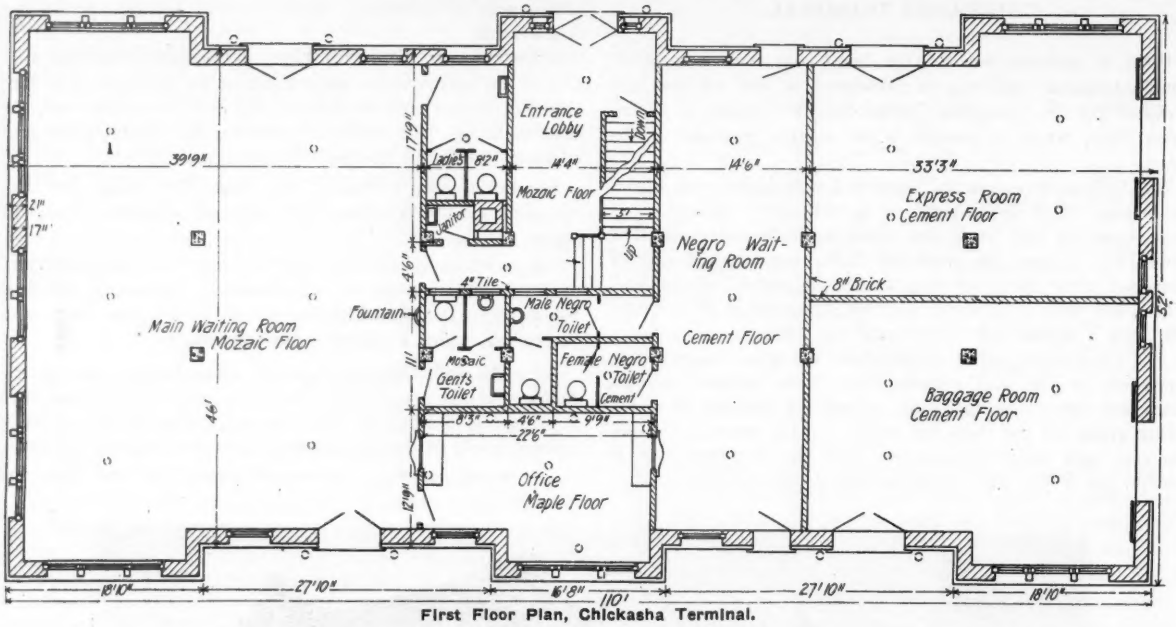
The main waiting room is approximately 50 ft. square and has a lofty ceiling 18 ft. high, which is divided into panels by the concrete beams, and also false beams which have been added to render the design symmetrical, and the room is dec-

the trenches are covered with cast iron plates, fastened in place with countersunk bolts. In this manner any repairs that may be necessary may be carried out rapidly and with little or no damage to the floors.

The roof, which is of concrete, is framed on the same plan as the second floor, so that at such time as may be expedient, a third floor may be added. Spandril beams are built in to provide for the stairs, and the foundations are of ample size to carry three floors. The roof consists of a 6½ in. reinforced concrete slab. Above this is a cinder filler which supports a top slab of cinder concrete sloped down to the sides of the building. A composition roofing was nailed to the cinder concrete.



Plan of Chickasha Terminal.



First Floor Plan, Chickasha Terminal.

A two inch water line is brought into the building, with fire hose outlets arranged at each floor.

All wires entering the building are brought in through underground lead covered cables, with distribution panel boxes at each floor. These wires include telegraph line for the dispatcher, a twelve trunk telephone cable, and electric light and power cables. In this way all outside wires are omitted, and the appearance of the building is much improved over the ordinary building with outside wires.

In the basement is located the heating plant, which is a low pressure gravity return system, and which at the initial test heated the building with 2½ lbs. of steam, within eighteen minutes of starting the fire. Coal storage of 40 tons is provided for.

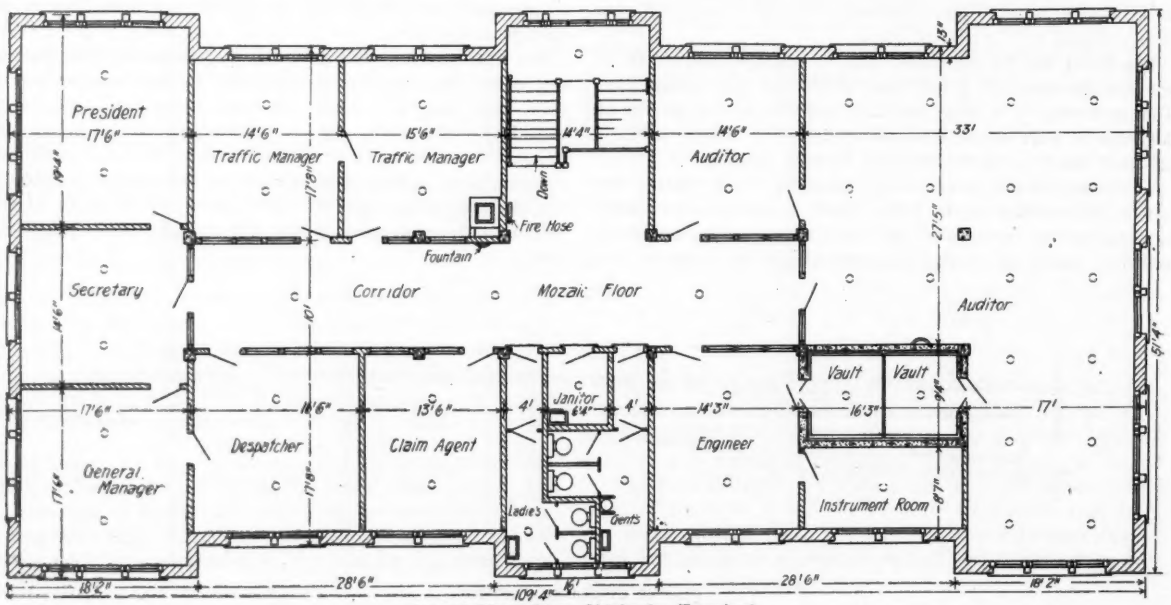
The main entrance has a wainscot of dark Creole marble, which is carried up the main stairs, and around the second floor corridor. All the trim throughout the building is plain red oak, finished natural color, in wax. All finishing hardware is dead black, and the contrast is attractive.

The second floor corridor is well lighted by borrowed lights from the offices, which are well arranged for the convenience of the officials. Two reinforced concrete vaults are provided, one for the auditor and one for the engineer. They are divided by a steel grille, so that ample ventilation is afforded by opening the two doors. Plug connections are provided for the vault lighting.

The second floor consists of a 6½ in. reinforced concrete slab, on top of which is a 2½ in. concrete layer, into which nailing boards 1½x3 ins. were embedded. The nailing boards are slightly wedge shaped, with the narrow edge upward, so that they cannot be removed except by shearing off the concrete.

Extensive use was made of reinforced concrete lintels, above doors and windows throughout the building.

A steel frame marquis, with wire glass roof, is to be built on the west side of the building, and as is also a train shed of similar construction to extend the full length of the building on the track side in the near future. Sanitation, heating,



Second Floor Plan, Chickasha Terminal.

ventilation and electrical problems have all been well thought out in this building, and provision has also been made for the subsequent installation of a vacuum cleaning system, which will have three outlets under the train shed, for the purpose of cleaning cars, in addition to outlets on each floor for the use of the building.

The concrete, both for stations, floors, stairs, etc., was all poured from a derrick, about thirty feet above the level of the work. This derrick was raised from time to time, as the work proceeded, so as to give sufficient gravity to run the concrete to the desired places.

Harold Macklin, of Chickasha, was the architect, and Clarence W. Noble, of Toronto, Ont., Canada, was the engineer on the concrete work.

CONCRETE PRACTICE, N. Y. C. & H. R. R. R.

A. M. Wolfe, Contributing Editor.

Continued from June issue, page 293.

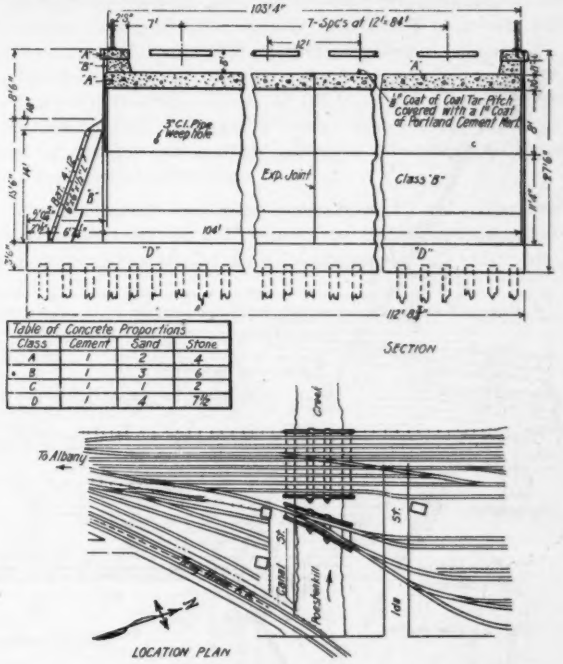
The structures described and illustrated herewith are plain and reinforced concrete arches (used extensively by this system); overhead highway bridges, steel protected by concrete, or reinforced concrete, and encased girder highway approaches.

Plain Concrete Arch Bridge.

The plain concrete arch bridge shown is an eight-track bridge of the circular segmental type with plain concrete spandrel retaining earth fill and track ballast. The grade of concrete used in the various parts of the structure is in accordance with N. Y. C. & H. R. R. R. standard practice; Class D, 1 part cement, 4 parts sand and 7½ parts of ¾" crushed stone in footings; Class B, 1:3:6 mixture in piers from footings to springing lines of arches, and in spandrel walls; Class A, 1:2:4 mixture in arch rings and copings, and Class C, 1:1:2 for 2" granolithic finish for all exposed surfaces.

Piers and abutments of arches are built on piles and are battered ¾" to 1 foot. The starkwater of piers is protected by 6x6x½" angle in same manner as for standard bridge piers. The piers are built with a vertical key 1'x2'0" at top for keying arch rings to pier. The abutments are protected from scour by baffle wall extending four feet below bottom of abutment. Arch rings are keyed to abutments by right angle joints as shown in section.

The arches were designed for Cooper's E-60 live load with 30% impact; dead load, earth fill, 100 lbs. per cu. ft.;



Section and Location Plan, Three Arch Concrete Bridge.

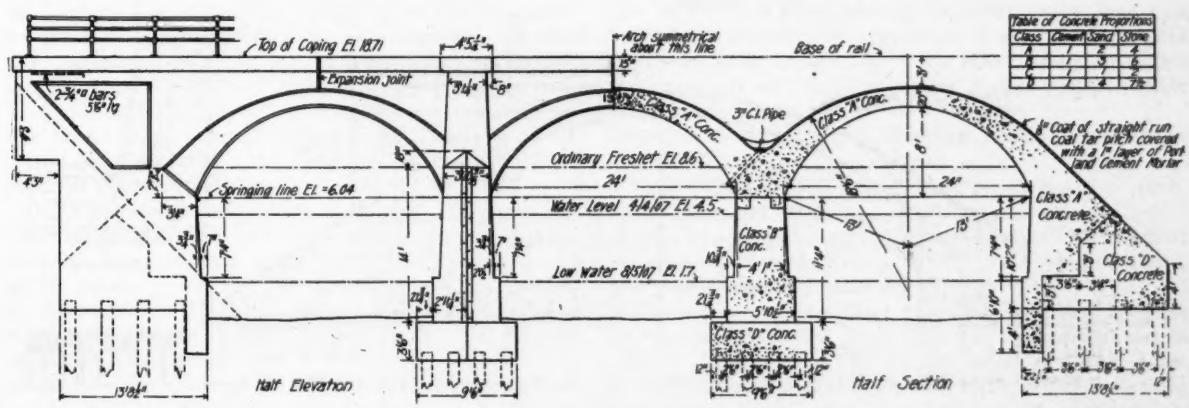
concrete, 150 lbs. Arch rings and spandrel walls are waterproofed with ⅛" coat of straight run coal tar pitch covered with a 1" layer of Portland cement mortar. An expansion joint of tar paper coated with ⅛" of straight run coal tar pitch, extends the length of structure at center line parallel with tracks, except in footings. The spandrel or parapet walls of the gravity type with back batter of 2" in 12" have a similar expansion joint at the crown of each arch.* The top of arch rings over piers are sloped so as to provide for drainage through 3" C. I. pipes placed as shown on plans. All exposed edges and corners are rounded to a 1" radius, except where bevelled.

The arch ring projects 2 inches from spandrel face. The beveled edges of same and set-in-panel in spandrel over abutment together with projecting coping and neat gas pipe railing give the bridge a plain but pleasing architectural appearance.

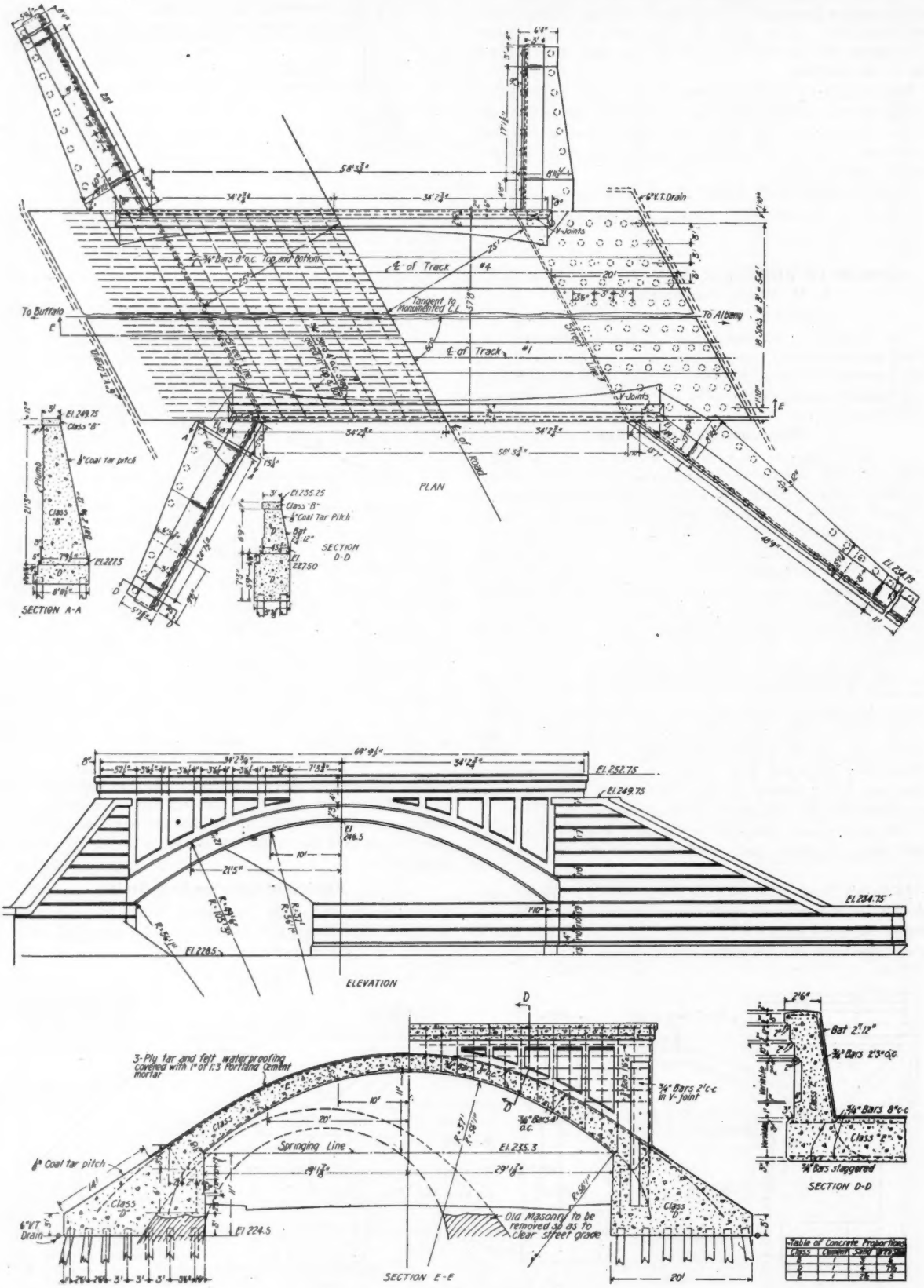
Reinforced Concrete Arch Bridge.

A 4-track 60° skew reinforced concrete arch with 3 centered arch rings and reinforced solid spandrel wall is shown in accompanying drawings.

*Editor's Note: The placing of expansion joints in spandrel walls at crown of arches is a departure from the generally accepted practice of having the expansion joints in solid spandrels at the piers.


Top of Coping El. 18.71
Expansion Joint
Arch symmetrical about this line
Base of rail
Table of Concrete Proportions
Class | Cement | Sand | Stone
A | 1 | 2 | 4
B | 1 | 3 | 6
C | 1 | 1 | 2
D | 1 | 4 | 7½
2-¾" ø bars 56'-0" lg
Class "A" Conc.
3" C.I. Pipe
Class "A" Conc.
½" Coat of straight run coal tar pitch covered with a 1" layer of Portland Cement Mortar
Ordinary Freshet El. 8.6
Springing line El. = 6.04
Water Level 4/4/07 El. 4.5
Class "A" Concrete
Class "B" Conc.
Low Water 8/5/07 El. 1.7
Class "D" Concrete
Class "D" Conc.
Half Elevation
Half Section

Three Arch Plan Concrete Bridge, N. Y. C. & H. R. R. R.



Plan Elevation and Section of Reinforced Concrete Arch, N. Y. C. & H. R. R. R.

The abutments and wing footings are of a 1:4:7½ mixture, Class D. The arch ring and spandrels are Class E concrete 1:2½:5. The wing walls are Class B, 1:3:6; ¾" crushed stone was used in all concrete.

Abutments are built on pile foundations with a key joint for arch ring as shown, the longitudinal steel from arch ring extending well into abutments. Wing walls on pile foundations are of the gravity type with a back batter of 2¾" in 12", face of walls being plumb.

The arch ring is reinforced as follows: ¾" sq. deformed bars 8" centers, top and bottom longitudinally, and ¾" sq. deformed bars 4'0" centers staggered in top and bottom transversely. In the spandrel, ¾" bars extending into arch ring are spaced 2'3" centers vertically near inside face and ¾" bars 1'6" centers horizontally near outside face. All bars were lapped 30" where splicing was required. The specifications required that all steel should be of approved deformed type conforming to the Manufacturers' Standard Specification of 1903.

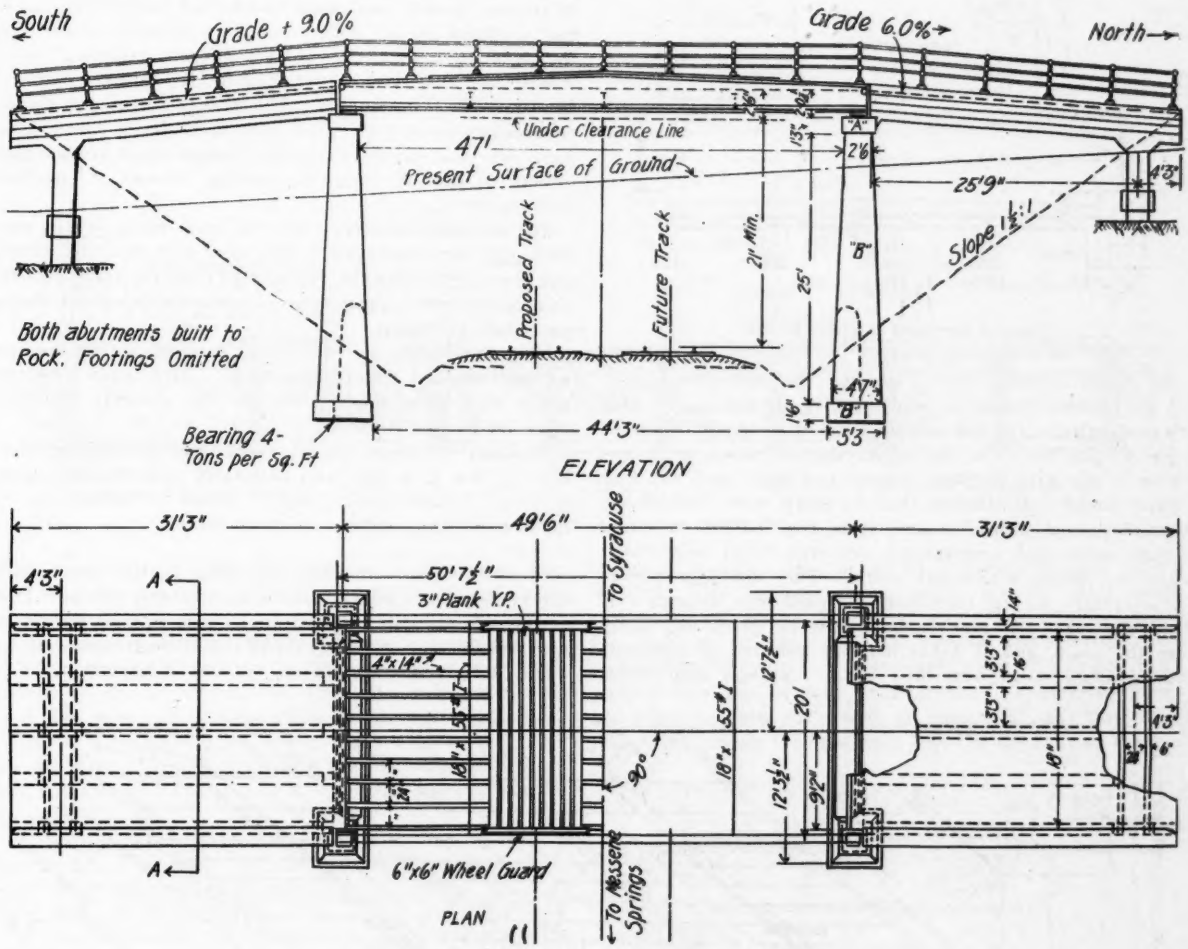
Loads assumed in design were as follows: Cooper's E-60 with 30% impact, dead load earth 100 lbs. per cu. ft.; concrete 150 lbs.; allowable unit stress in steel, 16,000 lbs. per sq. in. tension; unit stress in concrete, 600 lbs. per sq. in. compression. The following are the stresses as computed for a loading of 1,200 lbs. per sq. ft. Temperature range plus or minus 250 Fah.

Stress.	Crown.	Panel 3.	Springing Line.
L. L. & D. L.	385 lbs.	497 lbs.	397 lbs.
L. L., D. L. & T.	582 lbs.	565 lbs.	550 lbs.

It is interesting to note the increase in stress due to 50° variation in temperature, namely, about 50% at crown, 13% at panel 3 and about 38% at springing line.

The arch ring and spandrels are waterproofed with 3-ply tar and felt covered with 1" of 1:2 Portland cement mortar. Abutments and wing walls were waterproofed with ⅛" coat of straight run coal tar pitch. A 6" vitrified tile drain was laid around abutments.

The abutments and wing walls have 2" triangular wall joints from 1'10" to 1'7" centers to eliminate form marks and to conform to the style of coping and spandrel wall.



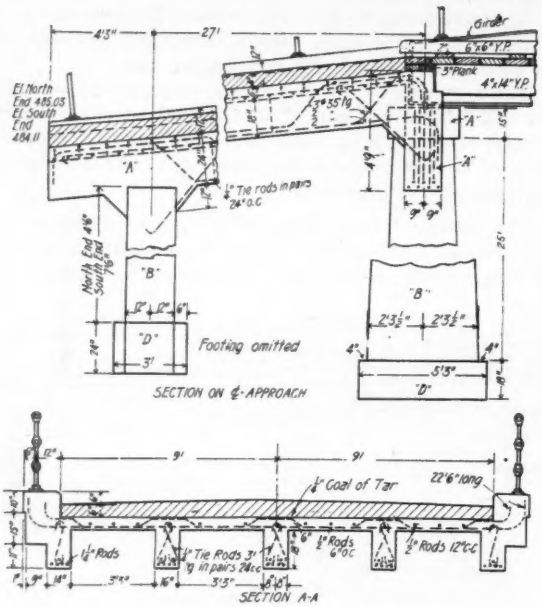
Overhead Highway Bridge, Structural Steel Encased in Concrete.

The structure is a fine example of what can be done with concrete to improve the appearance at a slightly increased cost over plain straight line work with nothing to relieve the monotony of the plain surface except unsightly form marks.

Overhead Structural Steel Highway Bridge Protected by Concrete.

The bridge shown is a skew span consisting of 17 cantilever trusses 149' 0" c. to c. of anchorages, with total width of 82' 0", encased in concrete. The suspended span at center is composed of plate girders 45' 0" c. to c. of connections. Minimum clearance over tracks being 21' 6".

The anchor piers are Class D, 1:4:7½ concrete; the piers up to bridge seat are Class B, 1:3:6, and bridge seat is Class A, 1:2:4 concrete; ¾" crushed stone was used. Class A concrete was also used in sidewalk slabs, to encase the three outside trusses on each side, in the hand rail, and to encase all other girders and trusses up to the springing lines of



Section Overhead Highway Bridge.

the cinder concrete arches, forming the roadway.

The general notes on material give an idea as to what was required in the way of cinder concrete. "Arches between girders and trusses to be cinder concrete mixed in proportion of one part Portland cement, two parts sand and four parts cinder. All cinders shall be clean, well crushed and screened coal steam cinders, from coal burned in steam plant under high temperature, delivered direct from boiler and not mixed with other refuse. They shall be crushed if necessary so that maximum size shall pass through a 1" mesh screen. All fine cinders must be sharp and gritty to the touch, and all ashes must be removed by screening or washing down with hose as the engineer may direct. Steel work to be in contact with cinder concrete must be first brush coated with neat Portland cement grout or covered with mortar as indicated on plan. All cinder concrete must have 1" facing mortar on exposed surface. Mortar to be 1 part Portland cement to 2 parts sand. All steel work covered by concrete to have one coat of Solvay Hydraulic paint in field."*

The total thickness of concrete protecting lower portions of trusses is 8½", and for girders 6". To tie concrete to trusses, ¼" dia. rods are wired 9" centers vertically and horizontally to trusses. For girders ¼" rods at 9" centers are held in place by ⅛" wires through webs. At the bottoms of trusses, girders and cross frames, 1:2 mortar was used, tied to flange by ¼" rods, continuous, wired to same. On the suspended span the bottom flanges, including cross frames, are still further protected by ¼" asbestos lumber, furnished in 8 ft. lengths. The reinforcement for cinder concrete arches is 3"x4" mesh wire cloth No. ⅜ wire. Wire mesh was also placed above top flanges of all trusses and girders to care for negative bending stresses in concrete over supports.

The sidewalk slabs are reinforced with plain, square, medium steel bars; hand rail is reinforced with expanded metal, and doweled to sidewalk. Reinforced concrete utility tunnels 3'x4' are provided under sidewalk slabs for telephone ducts, water and gas mains.

Unit stress used for reinforcing bars was 16,000 lbs. per sq. inch tension. Designing loads: Live loads 2-50 ton motor cars; dead load, earth, 100 lbs; concrete, 150 lbs.; steel, 480 lbs. per cubic ft.

Drainage for street car rail trough was provided by placing a 3" dia. C. I. pipe with perforated cover directly under each rail 6 inches beyond end of trough. Drainage for remainder of bridge taken care of on surface.

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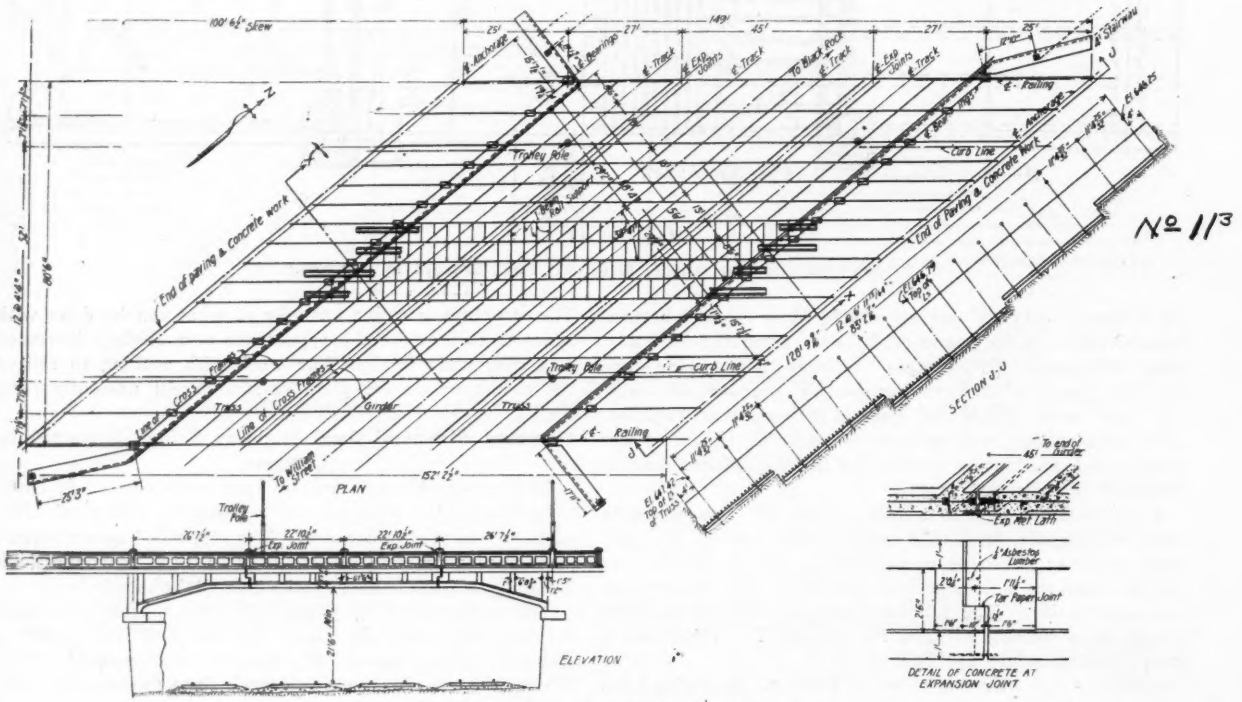
*Editor's Note: Attention is called to the specification for cinders for cinder concrete used in this bridge. It is needless to say that if specifications were fulfilled the cinder concrete is of good quality. The use of cinder concrete demands a rigid specification and the best of inspection.



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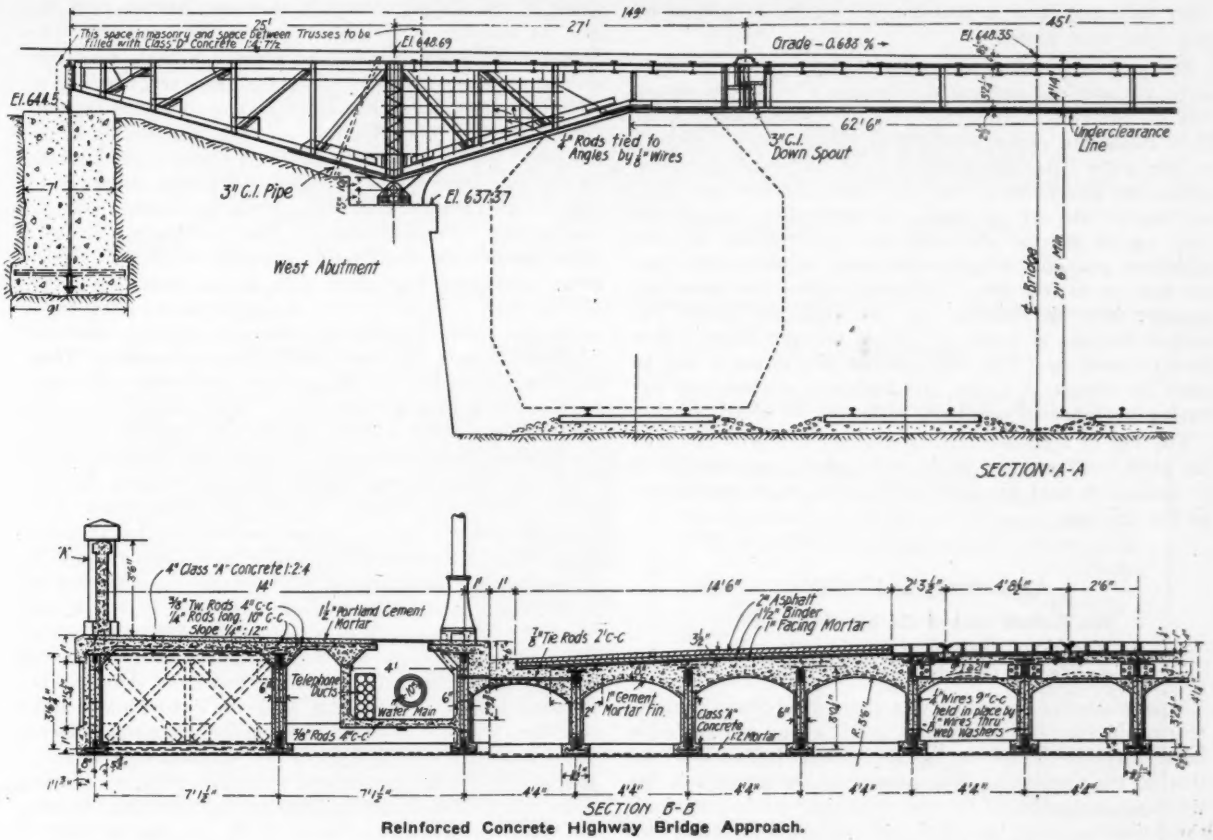
Plan of Overhead Highway Bridge.



Reinforced Concrete Highway Bridge Approach.

The appearance of finished structure is somewhat like that of a flat masonry arch with solid hand rail, with inset panels.

Reinforced Concrete Highway Bridge Approaches.

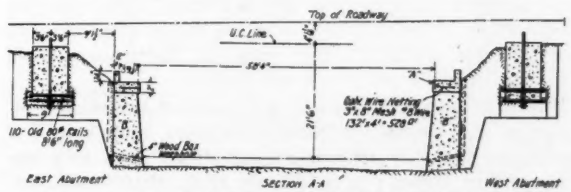
The approaches shown in the drawings are of reinforced concrete of the girder and slab type, the main portion of the bridge being a 50-ft. steel girder bridge with plank floor.

Class D concrete, 1:4:7½ mixture was used in the footings for piers. Class B, 1:3:6 was used in main portion of piers and abutments and Class A, 1:2:4 was used in girders and slabs.

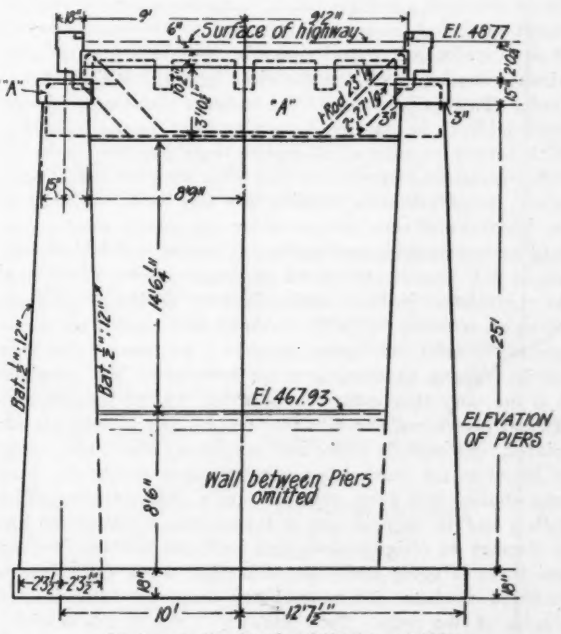
The abutments are plain concrete walls 2' 0" thick, resting upon rock. The piers are also of plain concrete 4' 7" square at bottom and 2' 6" square at top, with batter of ½" to 12". As originally designed a wall 8' 6" high was to be placed between piers parallel to track, but this was omitted in construction. The steel girders rest directly on the piers.

The loading used in design was a 13-ton road roller 5 tons on front roller and 4 tons on each of two rear wheels, 11 ft. behind front wheel, rear wheels 5 ft. apart transversely. A uniform live load of 100 lbs. per sq. ft. was also used. An impact load equivalent to 25% of roller load was allowed. Allowable tension in reinforcing steel 14,000 lbs. per sq. inch, compression in concrete, 650 lbs. per sq. inch. Steel used was plain square bars.

The 6" roadway slab carried by 5 girders forms a roadway 18' wide between curbs, which are 18" wide, and carried up 12" above the top of slab. The reinforcement for slab is ½" sq. bars 6" centers transversely; alternate bars being bent up at one-sixth point of span between girders into top of slab over girders. Transverse bars are bent up into curb wall at sides; ½" sq. bars are placed 12" centers longitudinally between the bent up trans-



Transverse Sections Reinforced Concrete Bridge Approach.



Abutments for Overhead Highway Bridge.

verse bars, and there is also one ½" sq. bar in bottom of slab over each girder.

The girders carrying the slab rest directly on the abutment at outer end and are cantilevered 4' 3" beyond center line of abutment. The pier ends of girders are carried by a transverse girder which transmits loads from girders to the piers. At the abutments and at transverse pier girder, the girders have a 12"x12" fillet reinforced with 2-1" sq. bars to take care of shear. All girder bars are bent up into top of slab at abutments as reinforcement for the cantilever portion. At pier end, some of the girder bars are bent up to take care of diagonal tension and some run straight into pier girder. ¼" tie rods are placed 24" centers in pairs in center of girders between points where bars are bent up. The transverse or pier girder is tied to piers by transverse girder bars both straight and bent up, having hooked ends extending well into the piers.

The top of approach slab is waterproofed with ¼" coal tar pitch. All exposed edges and corners are rounded to 1" radius. A neat gas pipe railing adds to the appearance of the structure.

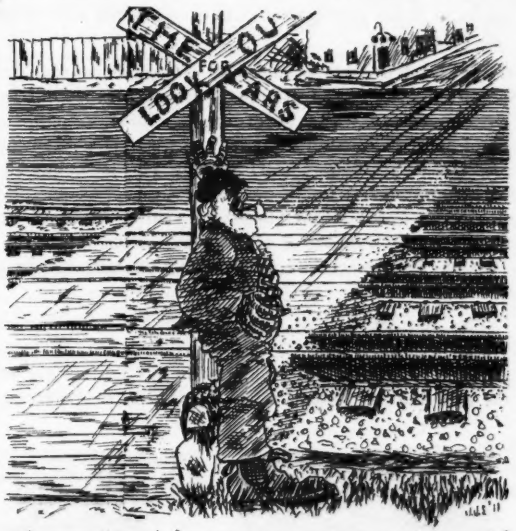
AMERICAN RAILWAYS.

As Viewed from India by "Indian Engineering," Published at Calcutta. In It We See Ourselves as Others See Us.

It is somewhat surprising that the United States with its vast ramification of railway lines, is still a long way behind in organization to the railway system in Great Britain and even that on the Continent. The mileage of the railways is five times per capita that of Europe, the freight traffic per mile is three times as great, but yet the rate per ton mile is less than half the average of that in Europe. The natural result of course is that, with certain notable exceptions, the working costs have to be kept down to the lowest limit possible, and lines have to be built with an eye more to economy than efficiency. To control the railways with the same rigidity, therefore, as lines are controlled elsewhere is out of the question, and equipment and working appliances have to be permitted that would be ruled out elsewhere. The disadvantages of the system, however, are being clearly perceived all over the country and a general call is being made for the state to permit an enhancement of rates and at the same time to adopt a system of control over the operation of inter-state railways similar to what is exercised by the British Board of Trade. To take up some of the features that ought without more delay to be improved we may refer to the following. With regard to railway accidents there appears to be no authority vested in anyone to deal with and pass orders upon defects in equipment or working that may have lead to them, the functions of state officers being apparently merely confined to investigation and report. The use of the block system is not compulsory on all passenger railways, nor have the operating rules been standardized for all inter-state lines. When an accident occurs it is usually investigated by the inspectors of safety appliances, because it is supposed that their special training qualifies them for such work; but complaint is at the same time made that many of the railways have inefficient inspectors, and also that reports of accidents are not printed. As regards traffic and accounting there also seems to be room for much improvement, since during the fiscal year ending 30th June, 1910, no less a sum than 22 million dollars had to be paid out in settlement of claims for loss or damage to freight; also, that undercharges are frequent and there is great laxity in recovering them, cases having occurred of claims for undercharge being put forward after a lapse of two years. Such lapses give rise to the suspicion that the railway, or some officer of it, has advisedly given a rebate to the shipper; and it is now proposed to limit the time for recovery of an undercharge to three months. The development, again, of cars and engines is being permitted without a corresponding betterment of the track, resulting in more frequent derailments. It appears to us that at the bottom of all these evils lies the fact that the railways in the States are at the present time earning scarcely a living rate. Though the state has but a lax grip over the companies as regards methods of working, leaving competition to take care of that, it rigidly controls rates; and having some 15 years ago brought them down to a point which then yielded a fair profit, has kept them since at the same level, compelling lines, in order to meet expansion in one direction, to economize rigidly in another, while costs of both labor and materials have in the same period risen enormously. Thus, if a company must, for the sake of competition with rival lines, invest in better engines and cars it has to take their cost out of maintenance, taking the risk of accidents from inadequate permanent-way, or weak bridges, both which might have been strengthened at the same time as the running equipment was improved, had there been means to do it. Expenditure on new lines and on branches has therefore given place to expenditure merely to meet competition, with the result that the development in mileage has slackened till from having been recently about 8 per cent, it is now only about 2 per cent, which is less than the rate of growth of the population. There are thus two elements of danger in keeping down railway rates for the benefit of shippers—(1) tht there will be a tendency to equip the line with appliances that there will be a tendency to equip the line with appliances that are merely contributory to the working, such as safety appliances, first-class track and up-to-date bridges; (2) that there will be a hesitation in building new lines and throwing out branches. The consequences of the first may be reflected in increased accidents, the consequences of the second may devolve eventually on the shipper himself, by providing no increase in the facilities for the carriage of his goods commensurate with an increase in production arising from the opening out of new agricultural districts away from the railway, or by the establishment of new industries in remote situations. Affairs seem to be reaching this position in both Great Britain and America, and will undoubtedly do so in time in India also, where there has for a long time been a cry that it is difficult to raise capital for railway construction although the difficulty has been ascribed to other causes. In the former countries a remedy must soon be found in a general increase of rates, it being clear that the people can stand it as there has been a general rise in prosperity and in the standard of living. In India, when it is desired to punctuate the advantage of British rule, it is also confidently affirmed that general prosperity has increased and the people can now afford to pay more for luxuries, let alone necessities, than they could a few years ago. If, therefore, by an increase of rates in India the extension of railways would be facilitated it may be worth considering if it would not be advisable, since it is admitted that at the present time the expansion is a long way behind the needs of the country and the expansion is prevented by a difficulty in finding the funds.

George B. Swift & Co., Security Bldg., Chicago, Ill., have been awarded a contract by the Michigan Central for the construction of a roundhouse, machine shops, office building and turntable at the Botsford yards, at Kalamazoo, Mich. The improvements will cost about $250,000.

The Pere Marquete receivers have ordered immediate construction of a $50,000 coal chute at Saginaw, roundhouses at Ludington and Port Huron, costing $50,000 each, new stations at Port Huron and St. Joseph, Mich., $50,000 each, and the purchase of 5,000 tons of steel rails.



Yis sore thim injineers sure are funny creatnyurs. It remoinds me of the toime whin Bill – him that is now Ginral Manager. – Oh yis I am a railroad man, or that I was ontill the officials discivered that I was nearly as old as they was and therefore onfit fur duty.

Yis sore fur many a year I was boss af the sichion down at Shady Blind, an a foin sichion it was if I do say so mesilf. In thim days they did not give a premium tward to thim as had the roughest track and the fewest wades on thier sichion.

But I was spakin af the toime whin Bill – him that is now the Gineral Maniger – was larnin to heare a number 2 under my superintindance. Thim injineers used to come along wid thier shiny brass onstruemints and squint about and drive me foine thrack full af thim dom stakes. But they niver cud git thim in the cinter so I pulled thim up as soon as they hav wint.

One foine day whin they was despoiling my thrack, Bill – him that is now Ginral Manager – he throps his number two when I was fillin' me poipe, an next thing I know he's peekin' at me thru that injineers brass onstruemint. "Hay Moike" he hollers that was a helava long jump ye tuk!" an by the Howly Saints" he sez "luking up "Here ye are back agin."

I thot he was crazy standin there wid a gleam in his oiye, and a shcratchin his hid. And thin he sez, sez he "Now I know why thim injineers make signs to ache other instead af talking.

"Bill" sez I to him, "Bill" ye'll be Ginral Maniger sum day, fur yere got whales in yer hid an a honest shorel does not feel good in yer hands."

J. J. S.

AN ODE TO A TECHNICAL EDUCATION

The Prairie State of Illinois
Contained a loutish village boy;
When passed, a youth, mid snow and ice,
Who answered questions, once or twice.–
'Ninjineer!

Though what he meant by that absurd,
Uncouth, and stupid, senseless word,
Was lost upon this stupid wight
Who ran and yelled with all his might–
'Ninjineer!

With his flag rod, of red and white,
Dogs and chickens were put to flight.
The words he used were "I dont think!
Get out of line you darn fool gink!
'Ninjeneer!

"Ware the cow-lot," an old man said,
"'Tis no safe place for you to tread."
A tear stood in his bright blue eye,
Still he answered, "I've got to try."
'Ninjineer!

These happy homes then saw a sight
Of bull and man in record flight.
On the far fence they heard him pant,
"I gained this post with margin scant."
Ninjineer!

He rose to fame at one swift bound,
This hero of the country round.
Then quoth the envious village boy,
"To beat his time will be a joy"
Ninjineer!

He tarried not to eat or drink,
But got a flag of lightish pink,
Then climbed the fence in manner brash
A shouting thru his blonde mustache,–
Ninjineer!

At half past six, next afternoon,
A sky-man in a big balloon,
Heard spoken above, mixt with groans,
The self same word in wheezy tones.–
Ninjineer!

Just as he neared the moon he stopt,
Quick as a falling star he dropt.
They put him in an empty sack,
And, brought him home upon their back

LE'NVOIS

They teach in the technical schools,
How to sprint according to rules,
To beat a bull, and that effsoon,
When chaining of an afternoon.

The Signal Department

UPPER QUADRANT SIGNALS IN GREAT BRITAIN*.

By J. F. Gains.

Hitherto the railways of the British Isles have adhered strictly to the usual types of "lower quadrant" signals, and in fact such adherence has been insisted upon by the Board of Trade in its regulations for the conduct of railways. But in connection with the introduction of automatic signaling upon one section of the Metropolitan Railway, it was decided to employ "upper quadrant" signals, and the necessary approval of the Board of Trade being obtained, this section of line has now been equipped in this manner. The system of operation is "all-electric" as designed by the MacKenzie and Holland & Westinghouse Power Signal Co., and the main objects aimed at were, the reduction of weight at the signals, the elimination of all mechanism except that actually adjacent to the semaphores, a diminution of the power required for actuation, and additional insurance that when released every signal shall, without possibility of failure, go to danger.

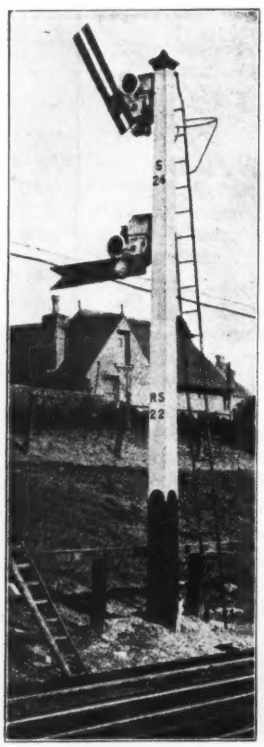


Fig. 1. Stop Arm in "Off" Position, Repeater "On."

Fig. 2. Both Arms in "Off" Position.

The advantages of the upper quadrant system are well understood in many countries, though in some places there are prejudices against them; and, therefore, their adoption by a leading British railway is particularly noteworthy. It is in connection with power and automatic signaling that the advantages of these signals are principally realized. As thus applied, it becomes possible to do away with all mechanism, whereas with power signaling with lower quadrant arms it is necessary to employ a certain amount of mechanism between the motors and the arms to ensure a gravity return, unless all the weight called for can be provided on the spectacle plate or otherwise on the other side of the fulcrum. Furthermore, as the whole weight of the arm itself tends to cause return to the danger position, and there is no need to compensate for this nor to overcome the frictional resistances of rods and the possible clogging of guides and pivots, it follows that the whole equipment can be made much lighter than heretofore. In addition, the shocks given to the post at each operation are reduced, and the power requirements are less, so that important economies in initial cost and in cost of operation and maintenance can be realized.

Figures 1 to 4 show examples of signals on the Metropolitan Railway. The stop signals are sometimes carried alone on convenient posts according to location, and in other cases with a "distant," or as it is termed a "repeater," below it. For sidings dwarf signals are used, but the latter correspond exactly with the larger signals, except that where two arms are placed together, neither being of course in such case a "repeater," one motor serves for both, though each has its own cut-out, so that only one arm can be operated at a time.

The motors are of special design, adapted to provide special efficiency, and as the arms have to be held off by power it follows that the slightest failure ensures the release of the arm and its consequent fall by gravity to danger.

Fig. 3. Dwarf Signal, Line Clear.

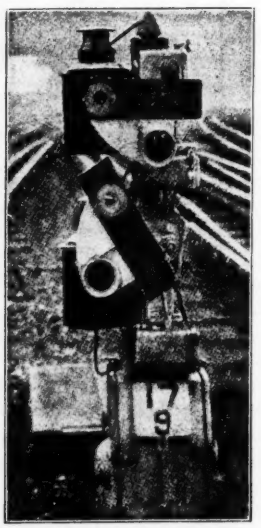


Fig. 4. Two Arm Dwarf Signal.

At many of the stations on the line, points have to be operated more or less frequently, and therefore in most cases the signal towers have been retained together with the manual levers; but for normal working, the levers are all thrown back and the signaling then proceeds independently of the signalman, under the control of the trains themselves.

When it is desired to operate points, the signalman breaks into the system by manipulating his levers, thus breaking all conflicting circuits and returning the signals concerned to danger. He then has complete control of the required movements until he returns the levers to their normal positions, thus restoring automatic working. All circuits are carried through the levers concerned, and rail contacts ensure that a train is protected until it has passed a sufficient distance beyond each signal.

*From a bulletin of the International Railway Congress.

While referring to the special signaling on the Metropolitan Railway, mention may be made of a three-position signal recently installed to meet special conditions at Edgware Road station. It is believed that this is the only three-position signal in the British Isles. It is a lamp signal, with three indications, red, orange and green. The arrangement of lines is shown by figure 5.

In the ordinary way the traffic is all of a through character, and as the signal in question is located about half-way along the platform it acts as a platform "repeater" of the starting signal, its indication is orange and green. There are, however, certain trains which terminate at this station, and these are diverted to the terminal bay for reversing. They are short trains of three cars, and therefore stop before the special lamp signals shown. When one of these trains arrives, the three-position signal is altered to red, the starting signal, which does not now apply, being placed at danger irrespective of what its position would be under automatic working. The train is then admitted to the bay line under the control of the small lamp signal alongside, which has only red and green indications. By this means the principals of signalling are maintained, for although it may be that it would not matter what indication were given by the three position signal, there would be some contradiction in the provision of a caution indication by one signal controlling the through route, while a clear indication for the terminal siding is given by another signal.

BLOCK SYSTEM ON RAILWAYS OF LIGHT TRAFFIC.*

The block-signal and train-control board in its repeated statements recommending the use of the block system has emphasized the need of that system on lines of light traffic, and to that end has advocated the restriction of governmental requirements to the most elementary terms; to the simple requirement that the space-interval system be adopted, with no stipulation as to methods of operating it or as to the construction of apparatus. Light traffic implies light income, and the railroad companies, therefore, so far as is compatible with the public interest, should be left free in the matter of detail.

The Baltimore & Ohio.

In the last annual report reference was made to the introduction of the block system on the Baltimore & Ohio Southwestern (now operated directly as a part of the Baltimore & Ohio). On 180 miles of this company's line, nearly all single track, the necessary apparatus for the operation of the manual block system was installed in less than one week, 62 offices being equipped with telegraph instruments and batteries and a new telegraph wire being put up throughout the length of the line (the poles being already in place).

Some additional information has been received concerning this installation. Including other sections on which the block system was introduced about the same time, the length of road is 254 miles, and the number of regular passenger trains each way daily is from 9 to 13 (on different parts of the road). The number of station operators now in service is 110, the pay rolls amounting to $6,262 a month. The number of telegraphers in service before the adoption of the block system was 64 and the total increase in operating expense made necessary by the change was $2,459 a month. The outdoor signals used are those formerly used to stop trains for dispatchers' orders.

On the question of the number of permissive movements necessary, which is one of the primary questions in the introduction of the block system on lines over which the volume of traffic is moderate, the record of three days of average traffic in the month of November, 1911, shows that the freight trains received clear signals at nearly nine-tenths of the block-signal stations. On the section of line here referred to, no permissive signaling is allowed for any train following a passenger train. For passenger trains following freight, permissive signals are allowed, and in the record here shown 86 such movements were made.

The headings of the columns in the table below are as follows: (1) Date; (2) number of passenger trains on train sheet; (3) number of freight trains on train sheet; (4) absolute clear signals given to freight trains; (5) permissive signals given to freight trains; (6) permissive signals given to passenger trains following freight trains.

The rules in force on this line contain the usual provisions for moving trains according to time-table rights and dispatchers' orders whenever the block-signals fail. Meeting points are fixed by time table and by dispatchers' orders, as in the general American practice on single-track lines. In addition to the ordinary requirements, a rule on this division (Rule S. 6) provides that when a meeting order is sent to trains a copy of the order shall be sent to the signalman at the meeting point; and also that this requirement shall be carried out even when the meeting point is a nontelegraph station; this by sending a copy of the order to two telegraph offices—one on each side of the meeting point; the operators at each of these stations being required to give a card to the train which passes him.

The Chesapeake & Ohio.

Another road on which the introduction of the manual block system afforded an instructive illustration of the simplicity of the problems involved in such a change is that part of the Chesapeake & Ohio west of Cincinnati.

The Chesapeake & Ohio acquired the Chesapeake & Ohio of Indiana, formerly the Chicago, Cincinnati & Louisville, in December, 1910. This is a line of light traffic running three passenger and an average of five freight trains each way daily over the eastern part of the line, and three passenger and three freight over the western part. No space-interval rule had been thought of until the Chesapeake & Ohio took charge. Indeed, this was a comparatively new road, built too late to be able as an independent line to secure any considerable amount of through business, and the receipts were so low as to demand the severest restriction of expenses. But the officers of the Chesapeake & Ohio had no sooner examined the condition of their newly acquired property than they decided to adopt the block system, and they did so with no appreciable addition to the plant and with an increase in the force of telegraphers of only 26 per cent. (The 39 telegraph offices were manned by 60 operators; this number was increased to 76); and thus the only addition to the pay roll is about $11,000 yearly.

1 Date.	2 Passenger trains.	3 Freight trains.	4 Clear freight.	5 Permissive freight.	6 Permissive passenger.
Cincinnati district east bound:					
Nov. 2	9	9	134	9	6
Nov. 3	9	6	96	7	4
Nov. 4	11	9	124	9	5
Washington-Louisville district east bound:					
Nov. 2	13	17	130	20	12
Nov. 3	13	14	122	14	10
Nov. 4	14	16	126	18	13
Cincinnati district west bound:					
Nov. 2	9	6	96	5	9
Nov. 3	9	6	90	10	8
Nov. 4	9	8	126	8	10
Washington-Louisville district west bound:					
Nov. 2	13	15	122	17	4
Nov. 3	13	15	116	29	3
Nov. 4	13	14	123	8	3
Total	135	135	1,405	154	86

At the east end of the line trains are run for 6 miles over the Cincinnati, Hamilton & Dayton; and at the west end for a considerable distance over the tracks of other companies, so that the length of line within the jurisdiction of one dispatcher is 256 miles. From the eastern terminus to Peru, 155 miles, the average number of freight trains each way daily is five. West of Peru, 101 miles, the average number of freights each way daily is three.

In one average day (November 7, 1911) the number of permissive indications given was as shown below. Peru is about

*From the report of the Block Signal and Train Control Board.

midway betwen the termini of the road, and the dispatcher's office is at the Peru shops. The runs of the local freight trains are from Summit to Richmond, from South Richmond to Peru, and from the Peru shops to Griffith.

Eastbound Trains.

Local freight No. 86, Griffith to Peru. Clear blocks to Beards-Beardstown to Kewanna, 13 miles; thence clear signals to Peru, town, 46 miles; permissive, on account of a work train, from 28 miles.

Eastbound through freight No. 92. Clear at every block except three permissive signals east of Peoria (Peoria, Okeana and Fernald).

Second No. 92, starting at Peru. Clear blocks 56 miles; permissive one block 6 miles on account of work train and thence clear to Peoria; permissive Peoria to Okeana, 7 miles; clear thence to Summit.

No. 84 local freight, Peoria to South Richmond. Clear blocks Peru to Gaston, 46 miles; permissive through Muncie yard; clear Muncie to Richmond, 40 miles.

Local freight No. 82, South Richmond to Summit. Clear blocks South Richmond to Fernald, 33 miles; permissive thence to Miami, 5 miles; clear thence to Summit.

Extra freight No. 1218, starting from Peru. Clear blocks to Jonesboro, 33 miles; one block permissive to Fowlerton, 6 miles, because of local freight ahead; clear from Fowlerton to Summit, 122 miles.

Extra freight No. 1207. starting from Peru. Clear blocks from Peru to Miami, 145 miles, permissive Miami to Summit, 10 miles. (This is nearly all up grade.)

Westbound Trains.

Freight No. 71, Summit to Peru. Clear blocks all the way except permissive on account of yard engines at Richmond, Muncie, and Peru.

Local freight No. 81, Summit to Richmond. Clear blocks from Summit to Boston, 50 miles; permissive signals because of yard engines at Boston and South Richmond.

Freight No. 95, Summit to Griffith. Permissive block to Miami, 10 miles; clear blocks Miami to Williamsburg, 61 miles; permissive block thence to Economy, 6 miles; clear blocks thence to Griffith, 174 miles.

Freight train No. 73, Summit to Peru. Clear blocks all the way except for yard engines at Peru.

Through freight No. 75, Summit to Peru. Clear blocks all the way, the train being next behind a passenger train.

No. 83, local freight, South Richmond to Peru. Clear blocks Richmond to Medford, 33 miles; permissive signals for yard engine at Muncie; clear signals Muncie to Santa Fe, 50 miles; permissive signals for yard engines at Peru.

Local freight No. 85, Peru to Griffith. Clear signals all the way.

If the adoption of the block system is to be deferred because of light traffic, this would seem to be a case where such action would be justified; but even with this light traffic the chance —on 256 miles of road, all single track, operating a million to a million and a half train-miles a year—of having head-end collisions is not to be ignored; and a single head-end collision would not need to be very bad to cost $11,000, or a sum larger than the annual addition to the pay roll which was necessitated by the introduction of the block system.

And in resolving to reduce that chance, the officers of the Chesapeake & Ohio seem to have decided, almost instinctively, on the block system as the proper means, in the same way that they would adopt the air brake for stopping or controlling heavy trains or the best roadbed, ballast, and rails to guard against derailments. The block system has been in use on the Chesapeake & Ohio in Virginia, including a large mileage of single track, for over 20 years, and for several years on substantially all of the company's lines, and the simple, logical conclusion that the space interval is the only rational method of safeguarding trains against collisions has come to be on this road not a mere doctrine to be discussed in lectures, but a "habit of thought," to be put into practice without question.

The Chicago, Milwaukee & St. Paul.

The Chicago, Milwaukee & St. Paul was one of the earliest roads to use the space-interval system on lines where the traffic was light or fluctuating, and it will be of interest to examine specimen records of the practice on that line.

The line from Rondout, Ill., to Janesville, 66.7 miles long, is one on which there are three passenger trains through each way on each week day, two additional each way for 41 miles, and nine additional each way for 3 miles, with about the same number of freight trains. On an average day recently all of the trains in both directions, were given clear signals at every block station except one east-bound freight train.

On this line and on the other line of the same road hereinafter noticed the facilities at the stations are substantially the same as on the Chesapeake & Ohio and the Baltimore & Ohio; that is to say, the only important expense above what would be incurred in running the road without the block system is the addition to the pay roll for additional telegraphers.

Another interesting example is that of the Chicago & Council Bluffs division of this road, from Marion westward to Perry, Iowa, 137 miles, a section of an important main line, all single track. On November 18 last the total number of trains on this division was 15 westbound and 17 eastbound, as follows: Four passenger trains through west and five through east; seven freight through each way; three short runs west bound and four east bound.

The passenger trains received clear signals throughout, except as follows: No. 37 permissive at Atkins, Newhall and Van Horn; No. 4 at Bouton and Phildia.

Of the westbound freights two through trains receive clear signals all the way. Two of the short runs clear all the way; one for 31 miles and the other for 17 miles. The first freight on the sheet received clear signals, except at five places. The next freight received clear signals all the way, except at three stations. The next freight received clear signals, except at eight stations. The next train, running over only 43 miles, received permissive signals at two places. The next through freight received 10 permissive signals. The next through freight received clear signals, except at four stations.

East-bound freights received permissive signals as follows: A short run of 17 miles permissive at Bouton; a through freight clear at all stations, except three places. The next train received clear signals at all stations. The next clear signals, except four stations. The next, a through train, received clear signals at all stations, except five. The next train received clear signals at all stations, except one. Next came two short runs (55 miles and 43 miles), clear signals all the way. The next train, a through freight, received clear signals at all stations until it reached Tama; thence permissive for the rest of the trip, the block sections being long (21.5 miles, 12 miles, 11 miles, 10 miles). The next train, running for 74 miles, received clear signals all the way, and the next and last was a through train receiving clear signals all the way.

These examples of practice are here given for the purpose of illustrating the facility with which the block system can be and is used with only the minimum expenditures for signals, wires, apparatus and attendants. This memorandum is not to be taken as an expression concerning the correctness in detail of the practice of the roads referred to, nor as an approval either of permissive signaling in general or of its use in these particular instances; but the data given, while incomplete in some respects, show that on the lines cited nearly all passenger trains and a large part of the freight trains are constantly being run by the space-interval system, doing away with numerous varied and troublesome risks of the time-interval system. This

is a definite improvement accomplished. But, what is of equal and potentially greater significance, the facilities are always at hand for enforcing the absolute block system at any time for *all trains*. In case of snowstorms or dense fogs making it difficult or impossible for enginemen to see ahead, or when from any cause special caution becomes necessary, a word from the dispatcher puts into effect at once the rule forbidding all permissive blocking. Where it is necessary to provide against dangers from sudden local fogs, station telegraphers can be authorized to adopt this rule on their own motion without waiting for special authority.

The bills which have been presented in Congress by Hon. John J. Esch, of Wisconsin, as well as the recommendations which have been put forth by the Interstate Commerce Commission and by this board, have all been drawn in conformity to the condition which is here illustrated and which, indeed, prevails to a greater or less extent on nearly all railways which use the manual block system. That is to say, the primary idea is the establishment and maintenance of the facilities for enforcing the space interval between trains. The extent to which exceptions or suspensions may be allowed, while not unimportant, is, from a governmental standpoint, a secondary question.

The Maintenance of Way Department

Contest on the Labor Problem.

THE PRIZE contest for articles on the labor problem has attracted a great deal of attention from trackmen. Another publication has taken up the subject in a modified way, all of which goes to show that the labor question is one of paramount importance to maintenance departments. Some railways are dodging the issue as was evidenced by the statement of a roadmaster who is a regular contributor to *Railway Engineering*. He states: "We are not allowed to air our views on the labor question."

At the time we go to press there have been received 46 contributions, most of which will appear in this and succeeding issues. One contributor in submitting his article says: "I noted the announcement of the Prize Contest in the May issue and think it an excellent idea to bring out the ideas of experienced railway men on this labor subject, and feel that I should not neglect this opportunity to help along a good cause."

The contest closes July 15, and results will be announced in the August issue. Winners of the first two prizes will be notified immediately by letter.

ROADMASTERS AND MAINTENANCE OF WAY ASSOCIATION.

Indications are that the 30th annual convention of the Roadmasters and Maintenance of Way Association will be the largest that has ever been held in the history of that organization. Many letters are being received by Mr. A. M. Clough, president, and Mr. L. C. Ryan, secretary and treasurer, declaring intentions to be present Sept. 10 at Buffalo, N. Y. Mr. W. C. Kidd, president of the Track Supply Association, has made a prediction that seven hundred roadmasters will attend and participate in the deliberations.

FAIR PLAY FOR THE TRACK MAN.

O. S. No. 1.

Thousands for fines, but not one cent for increased wages, seems to be the only reply that railroads all over the country today are willing to make to the multitude of appeals going up to them from the track men.

These, in most instances, are not demanded, but appeals for decent living wages—wages that will permit men to enjoy some one or two of the comforts of life, instead of providing only the bare necessities, and that, not to the full extent, in the case of larger families.

I have been in the service of some of the leading railroads in the country for the past twenty-two years, and have studied the conditions in the various departments, particularly the track department. I have been deeply interested in reports of some of the record-breaking runs by fast trains; I have likewise been much interested in items describing the luxury and completeness of some of the equipment (cars and engines both), which appear from time to time in various periodicals. My hat is off to the man who can stand the strain of nerve racking record runs, and, while it is off, I am inclined to let my mind wander a little, beyond the man at the throttle and wonder if possibly some one else has not also had a hand in the matter. Of course there was the superintendent, the dispatcher and the train crew, but I am going to go still further and make sure that I have not overlooked anyone in giving credit and possibly a word of praise. Yes, there is one, seldom thought of when matters of tonnage, speed and safety are being discussed, and I think I will add economy for good measure.

Who has made possible this record-breaking tonnage; this high speed; this safe arrival at its terminal of this train de luxe with its load of human freight?

It was those little gangs of men at intervals along the road, armed with pick and shovel, or tamping bar. Let me here ask just one more question. How far do you think one of these Twentieth Century fast trains would get, with its cars worth a fortune, pulled by an engine worth another small fortune, in charge of one of the most skilled engineers obtainable, if it were not for these little gangs of men referred to? Not far, let me assure you. Who makes these fast runs possible? Who makes it possible for the engineer to draw any pay at all? The same little gangs of men, out possibly all night sweeping snow and now gaging a rail here, adjusting a switch-point there, or spiking down a dangerous plank that has heaved up with the frost, the neglect of any one of which might cause a bad wreck.

Have you ever observed a group of Officials on an inspection trip? If so, you will note that each, regardless of what department he may represent, will keep his eyes religiously centered on the track. Depots and buildings in bad repair, strings of "bad orders," and "scrap" engines without number will be passed without comment. On arrival at the end of the trip it is more than likely you will hear the remark, "Well, we've got a good railroad here." What foundation is there for this remark? Surely the buildings, cars and scrap engines do not justify it. No, gentle reader, it is the track alone by which the entire road has been judged. Why then should not the track man receive the recognition due him in the matter of wages and a proper attitude toward him by his fellow employes? At this time the question of an increase in wages is being laboriously threshed out, demands having been made for substantial increases by a body of men who for years have been properly classed as among the aristocracy of wage-earners.

I think if I were called upon to argue against this increase, before the Interstate Commerce or any other commission, I would use the simplest and best argument to be put forth. I

would say, "The track men are not receiving wages that they are justly entitled to and until they did, others need expect few concessions."

Why this unjust discrimination between two classes of men, both indispensable in the operation of a road? Why this hesitancy on the part of railroad companies to recognize the just claims of the men in charge of the track, and why should they not be recognized as an important factor in the make-up of the modern railroad?

I find few men in the world today not possessed with a spirit of fairness and have never met one, be he an official or a member of one of the various labor organizations who will insist that the track men are being fairly dealt with in the matter of wages and recognition. If entitled to them why does he not get them.

I can imagine as I write these lines, some reader asking: What foolishness is this? What hair-brained individual is this, who dares suggest any changes or betterments for track men?

The general manager will say: Let us not increase our expenses, but rather increase the efficiency of our men. How are you going to do it? My answer would be, pay better wages, thereby getting better men; men who would be anxious to remain in the service, every day of which increases their efficiency.

I am no Brandeis, with a hobby and armed with volumes of statistics, but I will venture the assertion that an increase of 25 per cent in wages of track men will result in an increase to the railroads of 100 per cent in efficiency. Perhaps some of my brother supervisors more fortunately situated than I and hundreds of others, will disagree, but if there is one I should very much like to hear from him.

Why are some of our greatest corporations today so successful? At least partly because they pay the best wages and get the best men by so doing. Wages that will permit of decent living and leave a little to put aside for a rainy day.

The average track foreman today should he be taken sick or have sickness in his family, must go in debt for his doctor bill. If this is not paid promptly he is garnisheed and loses his job, as railroads do not take kindly to garnishee proceedings, regardless of circumstances.

I have been asked how I obtained labor for my section gangs. I can hardly say myself how they are secured. Fortunately the present day section foreman is a diplomat and about as wily as a politician and if he is given any show at all, will by some means unknown to me, induce a few to work for him. The earlier in the spring he is allowed to put on the additional men, the more apt he is to get them. If the matter is deferred a week or two later than the general opening up of spring work, the foreman is left in the lurch to struggle along short handed all season. I hold the foreman, not the men, responsible for the work on his section, and put it squarely up to him to pick out the best men he can, as it is to his own interest to do so. About the only concession he will ask is, that he be allowed to put the additional men to work early in the season. It is little short of marvelous to me where some of the foremen manage to pick up their men with the inducements offered, and I am beginning to believe it is a trade secret. Far be it from men to rob them of it.

Where do I get men for extra gangs is another question I have been asked. This is a much less complex problem (unless the matter has been too long deferred again). This is usually turned over to some labor agent, padrone, or interpreter, whatever you wish to call him. Every roadmaster or supervisor will receive during the winter from five to a dozen letters from various labor agents offering to send any number of highly skilled track men on short notice, and offering many inducements to set them to work. It is of little use to take notice of any of them. I usually have a line on three or four interpreters and as early as possible advise them how many men I want. Should I want 100 in about a week I will probably get about 10, but should I want only 15 or 20 I am assured I can have 100 in two days.

I was nearly paralyzed not long ago to have a gang of about 50 come to my office demanding work. I found on investigation they had been sent in reply to a letter written two days previous asking if the party to whom it was addressed could furnish 30 to 50 laborers, and if so, how soon. The poor fellows were rounded up, herded together, railroad fare collected from each and hurried forward on a promise of immediate employment at good wages. Needless to say there was some fireworks before the matter was straightened out and I think there is, or was, one interpreter less in the city where they were recruited.

An extra gang is a necessary evil nowadays, owing to the field being almost wholly occupied by foreigners. The novice will ask why employ foreigners? The answer is simple; it is because there is so much work to be done in the country that enough native labor could not be recruited up to do one-fiftieth part of it, hence the foreigner and the attendant evils referred to, chief among which is the interpreter above referred to. If there is a greater I have not discovered it.

The interpreter, ordinarily, is one of the meanest, smallest types of grafters in this country today. He can give the average native, even in politics, cards and spades and beat him. He will palaver around the roadmaster, make all kinds of promises to furnish first class men and then round up a bunch of derelicts, boys and shirks, charging them two to twelve dollars for the job, a dollar or two a month for bunk cars, which the company furnishes gratis, and by other tricks and deceit rob them of about all they make. I doubt if the average foreign extra gang laborer clears more than fifty cents a day, the result being that the railroad gets about that much work out of him. The interpreter once he gets a gang together is an agitator of the worst type and I cannot see why he is tolerated. Comparing the extra gang laborer with the regular section laborer the extra gang man has all the best of it from the railroad company. He is furnished a place to live, coal to do his cooking, stoves, and free transportation for all his supplies in express cars, enabling him to buy in a market at prices considerably less than local ones. The regular section laborer, should he buy outside of his own town, must pay express charges at regular rates on all shipments. The extra gang laborer is absolutely irresponsible. The section laborer must keep a most careful lookout, and be prepared at all times to remedy defects left wilfully or carelessly by the extra gang laborer. Do you think this is fair? Can some or any of these evils be corrected? I think they can. Dispense with the foreign interpreter. There are few gangs now-a-days that do not have men in them who understand enough English to carry out instructions given by an English-speaking boss and willingly convey them to their less fortunate countrymen. Hold good men on sections the year around, train them for assistant foremen and straw bosses and put them out in charge of extra gang work in the summer. Result, 100 per cent more added to efficiency column.

Does it pay to treat men considerately, including the foreigner? I say it does. They are strangers in a strange land the same as we would be in their country and I maintain that a nod, smile, or pleasant good morning will accomplish more than a scowl or an oath with ninety-five per cent of them. If you don't believe it, try it. Be tactful and get a man working at full capacity without his knowing it. If a man is delaying work by too much talking set him at something away from the men but do not let him know what it is for. If he is not keeping up his end tell him quietly but firmly to hustle; if he don't do it let him go with as little commotion as possible.

I would consider the three most essential assets of a foreman to be consideration (which must eventually get the good will of his men), firmness and fairness. A foreman with these is a jewel. When will we get such foremen? Some suggestions offered earlier in this article will materially help.

This is not written by a Nihilist or an Anarchist, but by a plain employe of the track department, loyal to his company whose best interests are ever in mind but who would like to see fair play for the man on the track.

HOW CAN WE SECURE BETTER TRACK LABOR?

Frank M. Patterson, Assistant Engineer.

In discussing the question of track labor and determining the best methods for improving a situation that is becoming all but intolerable, it may be of interest to review the past and the causes that have led to the present status. In doing this an attempt to understand economic theories and conditions will help us in analyzing the facts that we obtain.

In any field of labor the ability to secure workmen is dependent on a variety of circumstances, chief of which are the conditions of work, pay for labor performed, and opportunities for promotion, or at least the prospects of making more than a bare livelihood. Inseparably associated with these influences will be found others such as the condition of the labor market, both general and local, cost of living and the occupational tendency of the community.

During the early history of the railway, all of these factors were such as to attract a good class of labor to track work. (This refers more particularly to the middle west, but the general proposition will hold true for all parts of the country with a few exceptions.) Manufactories were few, the price of farm products was low, while the great expansion of the railway systems offered opportunities for work at what were then very good wages, under conditions better than those found in other fields and with chances for advancement for the ambitious and specially adept. Added to this was the lure of the railway, second only to the call of the sea for the adventurous youth who was tired of the humdrum existence in prosaic pursuits.

With the growth of population in the West came conditions more nearly approximating those in the older parts of the country. Manufacturing increased in order to supply home wants, as well as to take advantage of cheap fuel and available raw material, and this was accompanied by increased wages and opportunities for the worker. As a result of this expansion of trade, and the simultaneous development of the fertile agricultural land, the price of farm products advanced and conditions of farm labor grew materially better, attracting the emigrant to this form of labor and inducing the boy reared on the farm to remain on it. At the same time the wages of those engaged in the building trades were growing higher and higher as the demands for their services increased.

While these fundamental changes were in progress in nearly every field of labor, how was it going with track labor? Anyone acquainted with the subject needs no reply to the question. There was little increase in the pay for this labor, certainly none to keep pace with wages in other pursuits or with the increased cost of living. It is true that a part of the higher wages in these other lines was due to the exactions of the unions, but aside from this there would have been substantial advances due simply to the law of supply and demand.

But it may be argued that this same law of supply and demand should have operated to secure for the track man a wage increase commensurate with the others. True, it should have done so, and that it did not simply shows that the demand did not offer inducements to attract the supply. Conditions today show that the demand existed but was not directed properly.

It may be safely asserted that the cause of the decline in the quality of track labor, beginning at the period referred to, was due to a lack of the recognition of proper organization for this class of work, or as it is known today, scientific management. This term has a great vogue at present, and there are those among its prophets who hail it as the new born Moses, who is to lead his chosen people into the Land of Promise. There is no doubt that the recent agitation on this subject by many able men, notably Mr. Frederick W. Tatlor, has been of great value to mankind, but scientific management is almost as old as civilization, and the beginning dates back to the time when man ceased individually to supply all of his needs by his own handiwork and instituted the division of labor into trades or crafts. In other times it has been called common sense.

All of this is but a prosaic and perhaps tiresome preface to saying that while in other trades the men are classified according to their ability to do certain definite duties, and paid according to this ability, no such distinction is made with track gangs, and the recruit who has never done a day's work on the track is paid the same as the most expert laborer in the gang. Perhaps one may obtain a better perspective as to this if he will try to imagine a gang of masons in which each man indiscriminately unloads brick, mixes mortar, carries the hod and lays the brick, and in which the wage of each is the same as that paid common labor in other pursuits.

That this condition exists is due to the fact that track work has always been considered common labor. This assumption was not wholly true in the past, and is far from true today, for a great deal of the work necessary to maintain track to the desired standard, demands skilled labor and cannot be done economically by any but skilled workmen. If this was not recognized in the past, it was because it was possible to obtain the laborers skilled in the work at common laborers' wages. But ask any roadmaster who has seen the personnel of his gangs change in ten or fifteen years, from the workmen of the old type to the ignorant foreigner of the present, and he will assert that the men he used to have were worth three or four of the present. Allowing for exaggeration and pessimism, who is there who has had experience with both classes of labor that does not sincerely believe that the trackman of the old school was capable of doing at least 50 per cent more work in skilled lines than his successor of today, and that his work was at least 50 per cent higher in quality?

Having thus reviewed the past, and having demonstrated the chief causes of the decline in the efficiency of track labor, can we not hope to better conditions by an organization that will attract to itself industrious and ambitious young men and that will at the same time enable us to maintain our roadways better and more economically than under the present system? The writer believes it can be done, for a beginning has been made by the Union Pacific, where by placing the maintenance of signals under the charge of the section foreman, and by the use of motor cars, instead of handcars, a material saving has been made, while a substantial increase has been made in the wages of the section foremen and an assistant foreman provided for each gang.

The writer believes that this principle can be carried further and that the section gangs might also do much of the work that is now done by the bridge gangs, such as lining trestles, renewing ties, and other minor repairs.

It is possible that this country may have in time a peasant class, a class whose members have no ambition other than to work for a bare living at the labor their fathers engaged in before them. When this condition arrives the roadmaster may have some peace of mind, but it will not be for the road-

master of today who is confronted with the necessity of moulding the available unsatisfactory material into efficient trackmen, or of securing by the proper means the energetic, resourceful workman who has made American manufacturing noted for its skill and efficiency. These are the alternatives. Which shall we choose?

THE FOREMAN'S TREATMENT OF THE LABORER.

C. E. Boone, Roadmaster.

Where possible, I have the section foreman hire his own men with the understanding that he is to secure men that can read and write the English language. I find that better results are obtained by allowing the foremen to hire their own help than by the roadmaster hiring them, as it occasionally happens that the foreman will have trouble with a man that has been hired by the roadmaster. When hired by the roadmaster the men will, at times, act in a somewhat insubordinate manner, and to a certain extent ignore the foreman, claiming that they were hired by the roadmaster and try to convey the impression that the foreman cannot discharge them.

On the other hand, where the foreman engages the men I have found that they are more loyal to him and invariably make better trackmen, and also make better foremen after they have had the necessary experience to fit them for such position. We have hitherto been able to secure all the men we have needed in the vicinity of our road.

In connection with section gangs, it is undoubtedly a fact that the disposition or temperament of the foreman has considerable to do with the length of time that a man will remain on the section with him. What I mean by this is: a disagreeable foreman, no matter how good a trackman he may be, cannot keep a crew of men for any length of time, but is almost constantly making changes which puts him to the necessity of breaking in new men; and a man that works with a foreman of this class is apt to disparage the foreman and the railroad in general. In this connection I have in mind a case where an underhand was temporarily put in charge of a section; this man was an exceptionally good man, a good worker, perfectly sober, and a good, all-around trackman, thoroughly reliable, but was unable to keep a man for more than a few days, and I have on several occasions found him for a day at a time without any man to work with him. The men who had been working with him did not claim that he worked them too hard, but the whole trouble appeared to be that he did not have the faculty of speaking to his men in a proper manner. I tried this man as foreman temporarily on three different occasions, and met with the same result in each instance, in fact, he was gradually getting worse and harder to work with, and it was not possible to hire a man in that particular town to go to work with him, consequently I was compelled to discontinue using him as a foreman and set him back as an underhand.

To my mind, a foreman that can get along harmoniously with his men is able to get more work out of them, as he has their respect, and he, in turn, will try to teach them all he can, thereby increasing their efficiency and putting them in line for fitting themselves for foremen. Consequently a foreman of the latter class is much more valuable than one of the former.

I find that one important factor in getting track work done as it should be done is by talking with the foremen and explaining everything to them as far as possible. As an illustration of this: On one occasion I said to one of my foremen: "John, there are a few low joints at a certain point that you are neglecting." In reply he said: "I am putting in ties and I do not like to undertake too many jobs at one time." I then said: "John, supposing that you were a farmer and had your seed all in and growing and were building a piece of fence, and in going over your farm you should find one or two places in your fences that were in such condition that stock were liable to get onto your farm and do considerable damage, what would you do, stop and fix it, or keep right along with the other work?" He replied that he would stop and fix up the fences, that he saw the point I wished to make, and it has never been necessary for me to call his attention to matters of that kind since.

When a foreman does a good job, or good work in general, I think it a good plan to tell him so, as this not only convinces him that you appreciate his efforts, but that you are looking sharply after things. It also gives him to understand that the foreman who goes onto a section with the intention of having a good time, and doing only what he is compelled to do is liable to have a pretty hard time of it, and that it will be but a short time before his services as foreman will be dispensed with. Where a man starts in as foreman with the intention of fixing up the section in good shape, he certainly has the correct idea, and will not have one-half the trouble in keeping his section up to standard. The idea is for the foreman to push the work and never let the work push him.

I do not know of any better method to adopt to keep good men than by paying them good wages. A trackman has a trade that is not learned in a few days, and, in my opinion, one good trackman is worth two poor ones, and two good trackmen can accomplish as much as four poor ones.

When hiring men for extra gangs, we usually get Italians through the Italian labor agents. These men are furnished with cars to live in, and are usually paid at the same rate as section laborers. This class of laborers we use in the summer months only, in relaying rails and ballasting. They do not make good trackmen for the winter months, as the climate is too cold for them. We make it a rule to treat these men as well as possible, and in this way we can get better work and more of it than where the foreman is hounding them all the time.

TRACK LABOR.

T. Hickey, Roadmaster.

Section Gangs.

The majority of our track laborers on sections in this country are English speaking, although I have on a few sections some foreigners, Greeks, Italians and Austrians. Our yard forces are composed of English speaking men and foreigners, the latter in the majority, as we find it more difficult to hire and hold English speaking men in the larger cities, although we pay laborers in yards 5 cents a day more than is paid on outlying sections.

Our system is to hire our summer force commencing April 1st, and work them until about November 1st; reduction of forces of about 35 per cent is then made during the winter months. If summer forces are hired April 1st we can usually get all the men we want at that time, and as a general thing they will work all through the summer months, but if we do not hire our summer forces on April 1st the men whom we expect to get will hire out elsewhere, and the chances are that the section foremen, on several sections at least, will be short of men the greater part of the summer. It is important to hire summer forces early in the season, as by so doing the required number of men can easily be obtained by the foremen and better men can be secured. Foremen have men engaged for their summer force, in the majority of cases, expecting to be instructed to hire them April 1st. Should anything prevent and the foremen are not instructed, there is a disappointment. The men go in search of employment elsewhere, which results in a shortage of men on sections during the season, more particularly in small towns.

Where section headquarters are so located that there is no available house for the foreman to rent in which to live, a house is provided by the company for which the foreman

should pay a nominal rent, sufficient to pay 5 per cent on the money invested. It is a great advantage to have the foremen and their laborers, when possible, live in the company's houses, as the roadmaster would then know where to find them on short notice, if wanted at night. Foremen and laborers should be allowed to cultivate for garden purposes a small patch of ground on the right of way, where there would be no objection to doing so. It would be an encouragement to the men and no detriment to the company; in fact, it would be a benefit, as such cultivating may prevent fire from spreading, and will keep down obnoxious weeds.

Section foremen make a weekly work report. They are furnished a form on which to make such reports. On this report is shown the number of men employed each day and the amount and kind of work performed each day. It is surprising to note the interest taken by the different foremen in increasing their daily output of work, as each foreman tries to see if he can not do a little more than his neighboring foreman.

Some twenty years ago section laborers were almost universally English speaking, and in most cases native Americans. Conditions have gradually changed, and now a large proportion of track laborers belong to inferior classes and foreign labor. As is to be expected under these conditions, it is getting difficult to select suitable foremen.

To induce young men to enter the service, provisions should be made, I think, to pay a slightly higher rate than the average laborer's rate to one man in each gang, with the understanding that he remain in the service and be given opportunity to develop into a foreman. This would encourage at least a few good bright young men to enter the track service and remain, and would be the means of selecting good foremen. It is the ambition of a good roadmaster to have an organization of good foremen about him, the work of which he should appreciate.

Extra Gangs.

With the rapid change taking place in the character of forces making up extra gangs, the methods of organization of ten years ago have become inapplicable. The roadmasters who have studied conditions and revised their methods to meet these changed conditions are making the least complaint about the quality of the present labor. While the labor is not all that could be desired, in many cases the man who complains is not getting from it all that he can. Its quality will scarcely improve, and the problem facing the roadmaster is to so arrange his forces as to get the best results from the labor available.

A roadmaster has several first-class section foremen from whom he can select extra gang foremen. To change a foreman from a section to an extra gang should be considered a promotion, and recommendations for the position of assistant roadmaster can be made from extra gang foremen, according to ability shown and not on account of personal likes and dislikes, as is often the case. A section foreman used on extra gangs should not tend to demoralize the section organization. There is scarcely ever a time when a section foreman is promoted to an extra gang, but the roadmaster has a foreman ready to take charge of the section. The promotion of a section foreman should not disrupt the organization any more than the promotion of an assistant roadmaster to that of roadmaster, or assistant superintendent to that of superintendent.

Material should always be carefully distributed in advance of a gang so that there would be no delay or loss of time. The foremen should so place his men in doing the work that each man would do his part. For instance, in relaying rails he would place a certain number of men pulling spikes, a certain number of men adzing, wrenching, on tongs, spiking, etc., so that it will not be necessary to be continually changing some of the men from one place to another, with the consequent loss of time. This is particularly true with foreign labor; the same method can be carried out in doing other work.

A foreman should be furnished with a copy of all estimates of the cost of the work he is in charge of, to illustrate the advantage to the foreman of having such information as to the cost of work, and to give him a chance to do better than the estimate, or to explain its discrepancy.

A foreman should have good judgment and be familiar with the methods he intends to employ, both in the performance of his work and with different classes of labor. He should have force of character enough to uphold his opinion and give his men the impression that he thoroughly understands what he is doing. When a gang is organized, the first day is usually a try-out between the foreman and the men, as the gang is usually composed of some men at least who have had some experience in the class of work they are about to engage in. If he has confidence in his own ability, the foreman will start in as if he had just moved from one portion of the work to another; the gang will have confidence in him at once; results will be shown from the start.

The foreman should have authority to hire his assistant foreman and timekeeper (timekeeper should be under bond); he should have power to hire and discharge without interference. His decision should be supreme as far as the organization of his gang is concerned. Roadmasters and other officials should judge him only by results obtained. The roadmaster should examine his requisitions for tools, etc., and look over such requisitions with him on the ground. Tools and other supplies and material should be furnished promptly. If requisitions are reduced, the gang is hindered in making the progress it should, and this often reflects on the foreman on account of slow progress of the work, while in reality the fault is not his. Daily work reports should be made each day by the foreman, showing the number of men employed, the amount and kind of work performed, and these should be forwarded to the office of the division engineer and roadmaster; blank forms for such reports should be furnished the foremen.

Extra gangs should not be moved for small jobs. Instead of taking the extra gang away from an assigned job, and moving them perhaps a considerable distance, combine two section gangs for perhaps a day or two and complete the job. The extra gang may do the work in one day, but it work. A foreman is given credit according to the cost of the work, not according to the labor actually spent upon it, and the cost of transportation is not always figured in the estimate.

A foreman who is doing good work and giving good results, as a rule, has complaints made against him frequently. I have noticed where other departments made it unpleasant for the foreman, who has been told that if he cannot get along without so many complaints that there would be a change of foremen.

For the last five years I have dispensed with the services of interpreters in gangs of foreign laborers, after which I found that trouble with the men is minimized and greater efficiency is apparent.

THE LABOR QUESTION.

J. D. Archibald, Assistant Supervisor.

The change in quality of laborers now working upon railroads is due to various migrations from Europe. Northern European migration is not in as large a proportion as that of southern Europe, and the emigrants from these two sections are as different as night is from day. Years ago, when the Irish and German emigrants came from Europe, they developed and became our present day track foremen. They were better educated, well nourished, good workers, and with

their better education could think for themselves. As the migration changed to southern Europeans a poorly educated and more indolent class of emigrants drifted into the United States. Having heard of the large wages, they were attracted and did not realize that they must work.

Our division is within a short distance of a large eastern city; labor is hard to obtain at times and at other periods we can obtain it easily. If much municipal work is being carried out laborers are scarce and independent, but when this work stops the railroad can obtain all the labor needed. It has not been necessary to send to labor bureaus, as the laborers will bring friends and relatives for employment. For the first three months a laborer is paid 17c per hour and afterwards 18c per hour. The foregoing sliding schedule of wages formerly gave satisfaction, but so much municipal work is now going on for which still higher wages are being paid that our force of laborers has been reduced.

We make no attempt to classify men for either section or floating gangs, each foreman hiring such men as he may need. The doctors of the relief department examine each laborer's physical condition, this being a great help in preventing sickly, weak or under-sized laborers becoming a burden.

About one man of every ten in a gang develops into a fair track laborer, the other nine men taking very little interest in their work. In winter time, when unloading cinders, they will do very little, even to keep warm; some of them would rather freeze. If a foreman rushes them to finish work, they try to obtain transfers to other gangs with foremen who they think are easy to work with. The few who are interested in their work certainly deserve all credit; their lack of education and the fact that they are foreigners are great obstacles. Of these few some have become our assistant foremen. As assistant foremen they have done well, due to being placed with good foremen. They are the men to whom the foreman could say, "Tony, go put on a new splice at the heel of No. 7 track switch," or "tamp a low joint on No. 1 track at Mile Post 15." He would not have to drop attention to other important work and go with the laborer.

With some gangs it is difficult to obtain a fair day's work, while other gangs will surprise you by the amount they can do. There is a reason for this. The gang doing the most work has a *live* man for foreman; he is on the alert, has weeded out the drones. The men find they cannot trifle with him. He does not excite the men with loud or unnecessary orders. He issues an order and the men obey. Gradually the men come to respect him and he develops a good gang. The other gang has a foreman not very lively, it seems a case of "Come Day, Go Day, God will send Sunday." Gradually the laborers absorb his lazy way of working and no doubt the foremen will tell you his men are not worth much. With present day labor, where same is plentiful to pick from and with good foremen, it is not hard to obtain a good day's work. It is not necessary to drive men as machines or animals. The foreman can hold aloof, show consideration and hold the respect of his men.

A man is a laborer because he lacks education enough to command a higher place in the world's work. Good labor will always command a high price and this high price will exist especially during busy seasons. When a railroad wants a large number of laborers they will have to take the poor with good at first, and gradually weed out. On one of our sections, we have a tunnel 3,400 feet long, the lighting and ventilation being poor within same, and the laborers on this section are paid twenty-three and three-tenths cents per hour. They are good laborers and seem contented, very few leave or are discharged from our service.

The labor problem we will have with us always. No doubt another migration from another part of the world toward the United States may take place and it may be still lower in education. It is a question of how much labor can we avoid by, (1) good sub-grades; (2) sub-grades well drained; (3) sufficient heavy ballast under ties; (4) improved ties; (5) heavy rails; (6) improved track fastenings; (7) mechanical aids to reduce number of laborers; (8) higher wages for laborers; (9) physical examination of laborers; (10) good foremen, paid according to their responsibility.

LABORERS' WAGES TO INCREASE WITH YEARS OF SERVICE.

E. G. Lang, Inspector of Roadway.

The most satisfactory way to obtain laborers for both section and extra gangs is to be acquainted with laboring men in different localities, and through good laborers procure other good laborers.

Section foremen and extra gang foremen should be held responsible for the care of their men. They should be protected by the company for any favors they might show them, as the average laborer is not self existing, and foremen in all cases should be expected to look after his welfare. All extra gang foremen should board and handle their men,

The laborers I have been using for the past ten years have improved the track department wonderfully. These men are Mexicans. I find a great trouble in handling foreign laborers, due to the fact that the work is new to them and they have had to learn the trade of railroading.

It is difficult in some cases to get a fair day's work from the men, but I find the majority of the laberers today in the track department doing a good day's work.

We try to increase the amount of work accomplished by furnishing the laborers good tools and good equipment.

To improve conditions, I would suggest a scale of wages, taking into consideration the number of years a man works on one section or extra gang; and that all minor officials keep in touch with the laborers, promoting them as to their services and ability.

IMPROVED TOOLS AND CO-OPERATION.

J. C. Wilson, Foreman.

We try to induce laborers to remain with us by treating them fairly; looking after their physical and domestic comfort; making them understand that it is both quality and quantity of work that entitles them to a better place, either in or out of the service, and that a better place is awaiting them as soon as they are ready for it.

Some laborers make good track men while others make inferior track men. There is a great difference in nationalities. We try to increase the amount of work accomplished by scientific management; i. e., training them to the quickest, safest and most efficient methods of doing work. Laborers, undoubtedly, accomplish more if treated considerately. Those that must be "driven" should be released from the service at the first opportunity.

I think that track men are entitled to better pay. In order to obtain better laborers and increase their efficiency, we should provide improved and more sanitary quarters for employes; improved conditions for securing promptly foods, supplies and mail; provide stronger, lighter and latest improved tools; gasoline cars in most instances should supplant the hand car. A better rate of pay should be given foremen, following which the service could soon be culled of those incapable. Foremen should be appointed from the ranks, and besides being capable track men they should understand how to get the maximum of service with the minimum expenditure of the laborer's physical forces. The fact should be acknowledged that the maintenance of way department is as important as any other, in fact, the very foundation of the entire system. Last, but not least, it must be granted (and this knowledge should be correctly applied), that all departments of any system must co-operate for the highest efficiency of all.

OUR METHOD OF HANDLING LABOR.

Warren Peachey, Supervisor.

Our section gangs are made up of American laborers on all but two of our sections, on these we work foreigners. The native labor gives the best results and is the most agreeable class to work, and we get more work out of these than the others. We get more work out of American laborers by considerate treatment than by driving. In fact, you cannot get satisfactory work by driving these men. Our section laborers make good track foremen, as a rule.

I always try to pick out my section foremen from my own laborers, and by treating them considerately we get good work.

The only way to hold good men on section work is for the companies to increase the wages up to a standard with other laborers in other classes of work. When this is done, the best labor can be obtained, and you can hold them, too. To get a great amount of work done, a good foreman is required, who can arrange and manage his work to good advantage. The amount of work done, of course, depends on the ability of the foreman, so he should be chosen carefully.

My extra gangs are usually foreigners, as we do not have extra gangs the year around. We usually get Greeks or Russians. Last season we put in 25 miles of new gravel ballast with extra men, picked up on each section. This method gave better results. We got a better surface, and it held better than if done by an extra gang. Track ballasted by an extra gang soon gets choppy and out of line, and the regular section gang must go over the work again and snipe up the track. That has always been my experience.

SECURING TRACK LABORERS.

B. M. Hudson, Roadmaster.

From experience and observation I found it was best to ascertain what kind of laborers were to be picked up on the Division, and to learn from the foremen what kind of men they could work to best advantage; some of them do best with Mexicans, some with negroes, some with hoboes and some with native white labor.

Then I found out where laborers could be employed and requested the foremen and men to assist me, which I found they seemed well pleased to do, and unless labor is very scarce, we keep well supplied. Men, as a rule, dislike to pay an employment fee, and employment agents, as a rule, pick up any one they can get the fee out of. In most cases extra gangs can be filled, and kept filled in this way.

Most roads contract for the boarding of extra gangs, and the boarding contractor furnishes the men. This method has some bad features: The boarding contractors are in the business to make money and while they put out a man catcher, they do not, as a rule, get the best men. The board in some cases is not very good, because the officials who make the contract do not take the interest in the boarding outfits they should; the man in charge is trying to please the man he works for, and the men suffer, so do not stay. If the boarding is contracted, the men should be well cared for and the contractor protected, so that he can give good service and make a fair profit too.

The men that are used on track work are not the best, and the maximum efficiency is not gotten from the men who are worked. The best service is to be gotten by treating them well, and leading, instead of driving, them. The men must take an interest in the work, the officials and the company, and to bring this about, the officials must take an interest in them.

As an inducement I give the men as good treatment as possible, and promote them from the ranks, as much as possible, which I find works to good advantage. But with a raise in foremen and men's salaries I am sure a better class of labor could be secured and the efficiency of the men raised to justify the increase in salaries. I am sure we are not getting as much from the class we have, as could be gotten if living conditions were improved, and the men given more attention from the officials; for I find that the foremen graft off of the men to a greater extent than is thought of by the officials, which I think should be stopped.

The most important thing in track work is to secure better labor, and raise the class that is working to a higher standard of efficiency. With the best class of labor, which takes an interest in the Road's welfare, much can be accomplished.

Another important item is tools of the right kind and enough of them. The successful contractor pays salaries to get the best of labor, and always keeps men supplied with the best of tools, and will not allow any one to board the men, because he knows that the way to get the best results is to take good care of the men.

The time of railway officials has been taken up so much with their organized labor the last few years, that they have lost sight of their unorganized labor. Living expenses have been going up, and unorganized labor salaries have stood where they were when labor was more plentiful and living expenses much less than they are now. I am sure the efficiency of the unorganized labor can be improved on very much, and with better results to the railways and men than to allow them to organize, which they will do in time unless handled in the right manner.

PROPER PROVISIONS FOR LABORERS' COMFORT.

Wm. E. Bohl.

At the present time men are very scarce who care to work as section laborers, at most any price. Therefore railroad companies are compelled to look elsewhere than locally for their laborers. I have had several years of experience with different kinds of foreign laborers, and prefer the Mexican to any kind of foreign laborer that we may get.

Foremen can learn to speak enough of the Mexican language in a short time to successfully handle any amount of men. The Mexican language is easy to pick up, and this does away with the need for an interpreter. You will find the average Mexican willing at any time to perform the duties assigned to him, while other nationalities are more stubborn about performing duties assigned to them. It makes no difference with the Mexican what he is assigned to, he will work with a willingness to please you. The foreigners from southern Europe are more of a stubborn class of men and are not willing at all times to perform the duties assigned to them, and you are apt to have more or less trouble with them. That is my experience with foreign laborers other than the Mexican.

I do not favor an interpreter with any gang of men, as experience tells me that he will tell the laborers most any thing and keep the men in an uproar all of the time. The Santa Fe uses Mexican laborers almost entirely, because the results obtained are better than from any foreign laborer.

The simple way to keep men, and keep them satisfied, is this: You must train yourself to be patient, kind, but firm, and as soon as they learn what you want them to do the problem is solved, and the work will go along nicely.

Your company must prepare some convenient way of taking care of laborers, so as to keep them satisfied. I would suggest that a commissary department be organized, and that the railway sees to it that these men are not overcharged, and are dealt with fairly. Furnish good bunk houses for section laborers, and good bunk cars for extra gangs.

Kindness and good treatment will win with all classes of men. Do not be cross and crabbed with men because they

are what we call "green," and you will find by using this method that better results can be obtained.

If it becomes necessary to discharge a man because he has failed to perform the duties assigned to him, don't get mad and abuse him, but give him his "walking papers," and this will open the eyes of the rest of the gang, and all trouble will be at an end.

I learned this by experience, handling all kinds of foreign laborers. We must learn that men are all human, and that kindness will go further than rough treatment with all classes of men.

CHARACTERISTICS OF LABORERS OF DIFFERENT NATIONALITIES.

S. B. Peter, Roadmaster.

For our section gangs we endeavor to secure men who live in the towns along the line. And if unable to secure sufficient men at any town to supply the section there, we then endeavor to get men to move there to work.

Where it is possible to do so we work men who have family, or young men who have family ties of some kind, a mother, or some kindred with which to make their home.

A man who has no family ties will usually work only long enough to secure money to take him to the next job, and is liable to leave you in a pinch where you can not readily secure a man to take his place.

On account of low rate of wages paid section men, we have very little chance to select our men, but are compelled to take such as we can get and do the best we can with them.

An efficient foreman is able to handle his men by leading and not by driving them. It is possible to drive some men to a certain extent, but is much easier to lead them, and men that have to be driven to get the work, will be idle the moment the foreman's back is turned to them.

The foreman must secure the good will of his men, and in order to do this he only need follow the "Golden Rule," and treat his men as men, and fellow employees.

Where a man gets the idea that he is better than the rest of the gang simply because a little authority has been given him, and his wages are a little better than theirs, he will surely be a failure as a foreman.

The majority of men respond to fair treatment; and where possible to keep the same men on the section year after year they take more interest in the work, and accomplish much better results than where floaters are employed, who are usually looking for six o'clock and pay-day.

For extra gangs there is nothing that beats the Southern negro; but as they are seldom available in this latitude I will first consider the labor available.

We usually employ foreign labor, and the Italian is preferable, and if properly handled is a very fair laborer for all classes of railroad work. Very nearly all of them understand a little English, and if one should be found who does not it is always possible to work him with one who does. By this means you are enabled to dispense with the services of the interpreter.

And I wish to state that the interpreter is the source of nine-tenths of the trouble occurring among gangs of foreign laborers.

Greeks are next in order as extra gang laborers, and if so many of them were not "cigarette fiends," they would be preferable to the Italian. This for the reason that they are more peaceable than the Italian, and not so likely to get into a scrap with the foreman.

The Mexican should be classed as next to the Greek. He is usually easily handled as long as he comes out to work; but that will be only on nice days, and while he has no funds to take care of his thirst. As soon as he has a dollar in his pocket he is not available for work until he has exchanged it for booze and had time to sleep off his drunk.

On the other hand either the Italian or Greek will be ready to go at all hours of the day or night regardless of weather conditions.

In order to increase the efficiency of our section laborers it will be necessary to increase wages just a little, then employ our men all the year around.

The assurance of work during the Winter months while work is scarce would enable us to hold our men during the summer when labor is scarce. And every section foreman knows that it would be easy to employ the same gang very profitably in the winter months that is needed in the summer.

Securing foremen from the section instead of hiring boomer foremen will be a long step toward keeping our young men in the service for sufficient time to learn the work.

STATUS OF THE LABORER.

Thomas Cain, Foreman.

In voicing my sentiments in regard to obtaining labor for section gangs and extra gangs, I use the supposition as a basis that you can accomplish more when you treat a laborer considerately than when you drive him. Usually the American foreman is too broad-minded not to realize the advantage of such a method, thus ensuring a spirit of friendly co-operation among his men. Formerly and in fact quite recently, all discussions concerning labor assumed the working man to be a mere machine.

A comparison was frequently made between the sale of labor and that of any other commodity, without reflecting that the seller of a bushel of wheat cares not how, when, where or by whom it is consumed. Whereas the seller of a day's labor may be affected throughout his lifetime by the manner of that day's labor. The principal element which gives to labor its dignity and ennobling quality is its voluntary character. There is nothing ennobling about the toil of the slave crouching beneath the lash. The greater and more complete the independence of the worker, the greater the pleasure in his work and the more he will accomplish. Independence alone is one of the greatest incentives to offer laborers in order to get track work done. Give the laborer to understand that for his ability and earnest endeavors he will be treated as an American citizen, and that no labor, no matter of what condition so long as it is honest, is degrading.

Of course in our present day there are many classes of laborers to deal with such as foreigners, etc. But here tact must be used and conditions alone will warrant a foreman the harmony of control. Co-operation is one of the most effective means of insuring harmony between labor and the employer. It does not seek to plunder, neither has it its hand in another's pocket, but it means self-help to such an extent that you rise in position according to your own knowledge. Showing yourself competent in doing a certain kind of work is the surest and quickest way of obtaining promotion.

Again, keep the laborer employed permanently, divide and gauge the work so that it is as equally apportioned as possible, and you have the elements of successfully keeping the laborer satisfied.

PERSONAL CONTACT WITH LABORERS.

T. F. S., Roadmaster.

This subject of track labor is very close to the heart of every roadway official, and it is a problem which I have not solved to my entire satisfaction. I will give an outline of my methods of handling men. Regardless of the man's position my ideas would be followed out in the same manner. Now, that you may better sift the grain from the chaff, it may be best to state the conditions under which I secure

men, my source of supply (the labor market) and the results.

For the past six years there has been an abundance of work. The prevailing rate of wages for common labor is from $2 to $2.50, this being paid for eight and nine hours' work by the city, highway commission, gas company, electric railway company and ranchman. Our company pays $1.40 to $1.50 per day for nine and ten hours' labor.

Our foremen are mostly Americans, the laborers, Mexicans secured from the city.

Our labor market and source of supply is from San Diego, a small city of 55,000 to 60,000 population, having doubled in population in the last ten years and still growing remarkably fast. The building permits from January 1, 1912, to May 26, amounted to $3,318,900. In 1901 the number of building permits issued was 252, and in 1911 there was issued 2,999; the cost of new buildings in 1901 was $123,285; in 1911 this increased to $5,703,605. From the above it will be apparent that the grading, building of sewers, streets, 100 miles of highways, extensions of street car lines, and general activities have produced a great demand and produced a scarcity of labor. Work is to be had almost anywhere. In addition to all this there are two large dams being built and the new Arizona Ry. is being constructed, all of which claim their share of labor.

In order to secure and hold men under these conditions at $1.40 and later $1.50 it was necessary to draw an outline and method of getting men and keeping them, and at the same time to provide for getting rid of the service of the poor ones as they come without causing discontent and losing good ones. I will now outline my method of doing this before I give results. My object was to accomplish work in keeping with the rapidly increasing traffic.

The methods religiously followed are: A square deal to every man in our employ, getting in close touch with every man on the line as near as possible and staying there. In order that this be done according to my ideas it was necessary to proclaim myself judge in a manner which would not be resented by the foremen who I wanted to keep and through whose skill I was and am enabled to fulfill my situation satisfactorily.

With all respect to these faithful captains, nearly all whom were on the road when I came and are still with me, I have succeeded in working out a solution quite satisfactory to myself. Those in charge of foremen will appreciate the difficulty of securing the reins in their own hands without giving offense. I consider every laborer in the service a company asset. Collectively all depends on them and results accomplished with them. Next comes the foreman whose presence the laborers make necessary. These foremen then make it necessary for the company to create the position of the general foreman or roadmaster to direct the work and see that their orders are repeated and obeyed.

The foundation then, is laborers, then comes the foremen, then the general foreman. Without this staff no work can be done. These laborers and foremen are the tools, you might say, which the employer has placed in the roadmaster's hands to do the work with. He then must proceed to place these tools in condition to do the work and keep them in that condition and that depends wholly upon himself.

These humble agents are beings with rights of man regardless of the color of their skin. These tools are now in my hands to accomplish hard, laborious, tedious and mostly thankless work. It depends on me to do the work and keep these tools (which as I stated are not high priced), in repair and working order according to my own ideas; upon them my own position depends, back of which is my own home, wife and children.

I gradually made it known that no foreman on the road would be removed from the service without a good sufficient cause; that he would be permitted to remain permanently and have a job; that he could buy and make a home and become a good citizen if he chose, so long as he got results and obeyed orders. Nearly every foreman to a man now has a home along our lines. I then made it known that no laborer would be discharged without good sufficient reason, and that the cause must be sufficient according to my way and manner of looking at it, and if my decision was to give him another chance they must all abide by it. This in itself does not deprive the foreman of authority. It merely places the burden of responsibility of keeping or discharging a man on the shoulders of the roadmaster. The section men under me are handled in exactly the same way as a train master handles his train men, and if it becomes necessary for me to take some case in hand, I do so without fear or favor, either by going personally or sending for the offenders to come to my office, and by the way, none of them enjoy my coming or my sending for them.

In the first place camps made of old ties, which were white washed, were built, and given to men of families. To those familiar with the west these houses are common. Each family receives its cabin rent free. The houses are built at secton headquarters, and the men are provided with water barrels which are filled from passing trains. Old ties are supplied them for fuel. Every right belonging to the home is theirs. All these laborers are Mexican peons and these homes answer and satisfy their wants. The $2 and $2.50 Mexican laborer has high rent and buys everything he uses, while many of our men have little gardens, chickens, etc. There is not a man on the road, either laborer or foreman, who we refuse to help in times of sickness or trouble. Clothing, food or medicine will be supplied to tide over immediate wants. I do this personally, and I have lost very little money thereby. There are very few laborers on the sections whom I am not personally acquainted with. Men differ and fight occasionally and it becomes necessary to send one to another gang, or even discharge him; I attend to this as I think best. No foreman is allowed to curse, abuse, or wrong a laborer. It is merely a square deal asked and required of all.

There is less than a tenth of these laborers that can read or write a word, 75 per cent of them cannot speak good English. So you will see intelligence does not enter into their discipline to any great extent. If it becomes necessary to discharge a drinker, and he won't get along without trouble and you can't reason with him I sometimes boot him out of the office or job. Nearly every man we have as laborer considers me his personal friend and I never visit a gang that I do not bid the time of day to every one of the men, calling those by name I know. I do not encourage familiarity and no nonsense. I have charge of 75 miles of suburban lines and gangs scattered all around the city, and I have to be on the road all the time to keep in such close touch with the men.

The results can be summed up as follows: I have nine foremen, the oldest being in the service 24 years, one 18 years, one 16 years and all but two were on the road when I came. One of these followed me from the east. I have one laborer that has been with us over five years and many that have worked from one to three and four years. The new men hired in the spring and laid off in the fall come and go and our extra gangs are composed mostly of transients as all extra gangs. The back bone of our forces—our section gangs—are men of one to five years' experience, and I am full handed and have been right along.

I make the statement in closing this letter of my honest convictions. Treat a man like a man if you want a man's

work. Outline his work and keep him at it and he will accomplish a day's work. Save to him his respect of manhood, his respect for you as a man of judgment, and a friend and only aim to keep in section gangs those who will appreciate square treatment.

I do not advocate driving and won't keep a man that has to be driven. I can get men even at our $1.50 rate, to replace them.

I recommend just, firm and courteous treatment to every man. Never use force unless to protect yourself, and discharge only as a last recourse, for then you have done to the man the very worst you can. If he has any pride a certain amount, to say the least, disappears when you discharge him. He knows then you do not consider him as good as the others; he knows there are others in the gang that look on him as an outcast. I do not offer any other inducements except a chance of promotion and encouragement to foremen or laborers to come to me with their troubles. You will all agree with me that there are times when men are tired, discouraged and feeling that the whole world is wrong. Then, gentlemen, is the time for the stronger heart to manifest itself, then is the time to step up and say, "Never mind, boys, come on, I am in a hurry to finish this job, everything will work out all right." I cannot suggest any methods of securing better men. I am satisfied with the ones I have; most of them skillful and do their work to my satisfaction. To increase efficiency I can only suggest more careful planning and outlining of the work; urging but never driving; encouraging but never coaxing. I advocate employing resident labor and promoting your own laborers. By following this method you have men that are acquainted with your methods and practices. Your men have something to work for and you are acquainted with each man when he comes into charge of a gang and there is little guess work. We secure our extra or floating gangs from the local market, and it is very common to have laborers with families ask to be transferred to sections.

LABOR PROBLEM IN MAINTENANCE OF WAY DEPARTMENT.

W. A. Trimble, Clerk to Supervisor.

Those of us who have been connected with a railroad company even a short time have witnessed a great change in the labor problem in the maintenance of way department. It has been but a short time since we did not experience any trouble in securing laborers for track work, but today this question is among the most perplexing that confronts the railroad official. The Irish laborers, who for many years were the typical trackmen, have gradually dwindled in number to such an extent that the foreman who has a gang of Irish laborers is considered most fortunate. This class of laborers was replaced by a class of American laborers who had previously been employed in mills, mines, etc., and secured positions on the track in order to tide them over temporary embarrassments, and the service of such men was a menace rather than a benefit to the department, as they had no idea of remaining at this kind of work and consequently took but little interest in same.

The foregoing brings us to the advent of the foreign laborers, who undoubtedly have come to stay and will, hereafter, constitute to a large extent the personnel of the maintenance of way forces, both for foremen and laborers. The first and foremost matter of importance for the official desiring the service of laborers is to start or organize a colony of the particular nationality of laborers which he desires to use, and to do this it is first necessary that he get a man who is willing to start a boarding house or shanty in which the men can be accommodated until such a time as they may become acclimated, as it is a well known fact and very characteristic that the foreigner, especially the Hungarian and Italian, does not bring his family to a particular location until he is satisfied with both the work and location to such an extent that he will remain. When the boarding house has been erected the official in charge should lose no time in building suitable dwelling for the accommodation of the men, as they may eventually bring their families.

It might be argued, in this connection, that the employing officer will undoubtedly be put to considerable expense in the construction of suitable dwellings, but it is a fact which can be substantiated by men familiar with the customs of foreigners that it is rather unusual for this class of men to build homes or even shanties for themselves, but to their credit it can be said that they are willing and seldom object to the payment of a fair rental, which will pay a fair interest on the capital required to construct the shanties.

The payment of wages equivalent to those paid by local concerns and recognition of the rights of the men in an impartial manner are then sufficient inducement to hold them.

The foreigners do, in every sense of the word, make good track men as they have the prime requisites for such work; that is, they are strong and healthy, lose but little time on account of sickness, and are always on hand when wanted for emergency work because their homes and colonies are, as a rule, in very close proximity to the railroad and are easily accessible to the call of the foreman. It is true, however, on account of their lack of education they cannot often be used as foremen, and in many cases the foreigner who has the practical knowledge to fit him for a foremanship is not promoted to that position on account of not being able to handle the reports, etc., which the foreman is required to make. There are exceptions to this rule and I have in mind one Italian foreman who after being made assistant foreman applied himself to the work in such a manner and familiarized himself with the reports, by working with his foreman at night, that within a year he was made a foreman and is today one of the most efficient foremen on an important main line division, and the reports which he sends to the office are all typewritten and models of neatness. This man's promotion was due to the fact that his superior took a personal interest in him, not in the sense that he showed any partiality or granted any favors, but that he encouraged him in his work and studies.

To increase the amount of work accomplished is a problem which must be handled with the utmost skill and with a complete knowledge of the work to be performed. It has been found that making systematic inspections of the work on each foreman's division, taking into consideration the general appearance of the road bed, condition of the ditches, surface and line, loose and rattling bolts, etc., tabulating such information and passing it to the several foremen is a very satisfactory method. If a foreman finds that the section adjoining his own is in better condition, in these respects, than the track over which he has jurisdiction he will immediately take steps to correct the weak spots. By posting these tabulations in the tool house where the men can see and read them, it creates a spirit of rivalry among them and the foreigners, especially, are proud to be in the gang leading this list.

We do not consider it good policy to give work out by contract, or piece work, or tell the men that they may go home when such work has been completed, for work performed under such circumstances is not done in a careful workman-like manner.

There is no line of work in which it does not pay to treat men considerately, but it is the duty of the foreman to study

his men and it may be found that some of them actually do require driving, while others do their best work when treated with consideration. In this busy age when the work must be done, and some difficulty is experienced in obtaining laborers, the foreman is obliged to be a tactician and drive those who require driving and treat kindly those who can be handled successfully in this manner. In doing this he must, however, use great care lest he should be accused of partiality and create a spirit of unrest among the men.

We believe the matter of greatest importance in getting track work done is to keep the men in good spirit as they undoubtedly have much to make them otherwise, and the laboring men appreciate a word of encouragement, especially if it comes from the supervisor or the roadmaster and I believe it to be the duty of these men to keep so closely in touch with the conditions on the division that they will know a great many of the men in the gangs by name, and when walking over the sections stop and can commend the men personally on the manner in which they have performed their work.

The roadmaster or supervisor should endeavor to make his division as much like "one big family" as possible; talk with the men in regard to their work, discuss with them their personal matters, show an interest in the things that interest them and in other words live with the men and make them feel that he takes a personal interest in them. By doing this we feel that many of the difficult problems confronting the maintenance of way department as to labor conditions would be solved.

LABOR LESS KICKS EQUALS CASH.

George J. Sharkey.

From time to time labor difficulties arise, especially on the track and are very distressing to the men and employer alike. How many times are the difficulties a direct outcome of misunderstandings? I dare say nine-tenths.

In the organization of labor, and by labor I mean unskilled or non-tradesmen as for instance our average trackman, there is no reason why trouble should exist, as the men are acquainted with the wage to be paid and are satisfied to work at the rate quoted. Note where your chief trouble exists: Is it a too exacting foreman, who actually costs his company more than he saves by his breeding of dissatisfaction, not only affecting his own gang, but the entire force, as dissatisfaction spreads as disease, from one to another? Is it a burdensome commissary, where the men are charged too much for their grub, or think they are? The very fact alone of telling the men they must buy of the Padrone gives them a suspicion and breeds discontent. The average human being abhors anything which takes from him the right of decision, more so when his spending powers are concerned. Is it unfit boarding shanties or cars, which have been unnoticed, and when the men called attention to them the attention was not given? The prime necessity for good labor, skilled or unskilled, is good rest and good rest means good sleeping quarters. Have the men an abundant supply of good, wholesome water near their cars? Water is cheap, but how many times are the men compelled to holler for it? Are the men allowed transportation frequently, not too frequently, to go where they must, to see their families or friends? That is thoroughly appreciated by the men, and allows them an opportunity to get clean clothes and other changes and breaks the monotony of the grind.

The above is compounded in a single question: Is the roadmaster or supervising head a keen observer of little big things? The roadmaster is placed as a diplomat or smoother. Here and there he is bound to find a little trouble budding forth which if not nipped while in the bud, may cause a whole garden of trouble. And comparing the above to a garden, is no misplaced comparison. The roadmaster is the gardener and the laborers are his care; he must select well, he must weed out, without injury to the good workers, he must keep a steady growth, as his shall be the yield when the harvest comes at the end of the season. If he has planted, sustained and covered well, his resulting showing will be a pride and spur to something better. If he has neglected here and there, these little neglects will certainly show up and the law of average will rule as to results.

I find the best method of obtaining labor is by means of a salaried labor agent employed by the railroad company, who is to get the desired men, when the men cannot be obtained locally, the railroad to furnish cars or shanties allowing the men to purchase their own food supplies and pay no one anything from their wages by deduction. A deduction is a chance for a holler about graft—graft speaks dissatisfaction. Employ local men if possible, when local labor is as efficient as the labor to be brought in. Keep the men free from kicks even if you seem to humor them—more flies can be caught with honey than with vinegar. Pay a fair wage and obtain good labor. Promote where merited, irrespective of nationality, which gives all an ambition, and what is good and healthy without ambition? No ambition means stagnation; things stagnant rot.

Mr. roadmaster, go among your men and joke once a year or so, ask the men if they need anything and give them a wholesome jolly, and above all see that they have a good foreman, and if you have, make the men believe you consider the foreman the best you have, if you have to make fifty different gangs believe the same about fifty different foremen.

The Kansas City Terminal has awarded a contract to the Concrete Foundation Co., of Kansas City for concrete work on the South Broadway viaduct at Kansas City, Mo., in connection with the new terminal station. This contract involves an expenditure of approximately $50,000.

The Michigan Central is to begin work soon on the construction of a large roundhouse and machine shop at Kalamazoo, Mich.

The Montgomery County Rapid Transit Co., Norristown, Pa., is understood to be about ready to award a contract for the construction of a car house and repair shop.

The New York, Ontario & Western has plans under consideration, it is reported, for a double track bridge at Cadosia, N. Y., to replace the present single track structure on the Scranton branch.

The Oregon-Washington R. R. & Navigation Co. according to reports will shortly let contracts for the construction of two bridges. One structure is to be erected over the Snake River to cost $60,000 and the other over Tangman Creek and the Spokane River to cost $160,000. The material for the work will be furnished by the railroad.

A contract has been given to the North Eastern Construction Co., New York, to begin work on the new station of the Brooklyn Bridge, New York City, N. Y. The contract includes connecting the tracks of the subway under the new Municipal building with the Brooklyn Rapid Transit tracks.

Work has been started on the erection of machine shops at Tucson, Ariz., for the Southern Pacific, to cost $20,000, and it is estimated that $20,000 additional will be expended for new machinery.

The City Council of Spokane, Wash., has approved plans filed by the Spokane, Portland & Seattle for a reinforced concrete viaduct over 13th Ave. in Woodland addition.

Personals

E. J. Langford, principal assistant engineer of the New York Westchester & Boston, has been appointed acting chief engineer to succeed J. L. Crider, office at New York. Mr. Crider has accepted the position of superintendent of J. G. White & Co., and will have charge of the construction of the Oakland & Antioch, office at Oakland, Cal.

D. R. Morris, general construction foreman in the signal department of the Illinois Central, has been appointed signal engineer of the El Paso & Southwestern, with office at El Paso, Texas. He succeeds E. E. Backus, resigned.

F. B. Marble, division engineer of the Michigan Central at Detroit, has been appointed assistant chief engineer, succeeding R. D. Starbuck, resigned. The office is at Detroit. G. H. Harris, division engineer at St. Thomas, Ont., succeeds F. B. Marble as division engineer at Detroit and W. O. Houston succeeds Mr. Harris at St. Thomas.

W. R. Cohn, roadmaster of the Chicago, Rock Island & Pacific at El Dorado, Ark., has had his territory extended. R. E. Gallehan succeeds T. A. Palmer as roadmaster of the division from mile post 107 to Eunice, La.

M. B. Morgan was recently appointed roadmaster of the Illinois Central at Fulton, Ky. H. W. Carroll has been appointed supervisor at Mounds, Ill. J. E. Boland has been appointed assistant roadmaster at Corinth, Miss.

R. H. Gaines, division engineer of the Kansas City Southern, and chief engineer of the Texarkana & Fort Smith at Texarkana, Ark., has assumed the duties of M. A. Box, general roadmaster of the Southern division. Mr. Box has been appointed general roadmaster of the Kansas City Terminal and Northern division, with office at Pittsburg, Kan., succeeding Patrick Gratton, resigned.

M. V. Hynes, engineer maintenance of way of the Cincinnati, Hamilton & Dayton, has been appointed superintendent, with office at Cincinnati. H. B. Disk, engineer maintenance of way of the Baltimore & Ohio at Cincinnati, has had his authority extended over the Cincinnati, Hamilton & Dayton.

J. R. Stephens, assistant chief engineer of the Missouri Pacific, has been appointed chief engineer, succeeding E. F. Mitchell, office at St. Louis. Mr. Stephens was a graduate of the Stevens Institute of Technology in 1878, and began railway work with the Oregon R. R. & Navigation Co. in 1880. He has been engaged in railway engineering constantly since that date, holding positions with the Northern Pacific, Denver & Rio Grande, Grand Trunk, and Atchison, Topeka & Santa Fe. He was appointed assistant chief engineer of the Missouri Pacific about a year ago.

H. T. Porter has been appointed chief engineer of the Chicago & Alton, succeeding the late W. D. Taylor. The position has been vacant for several months. H. T. Douglas was formerly chief engineer of the Wheeling & Lake Erie.

G. G. Hare, engineer of the Kingston & Pembroke, has been appointed engineer of the Dominion Atlantic, office at Kentville, N. S. James Irwin succeeds Mr. Hare as engineer of the Kingston & Pembroke, office at Kingston, Ont.

A. R. Kelly has been appointed assistant electrical engineer on the California State Railroad Commission.

Mr. E. R. Lewis, division engineer of the Michigan Central at Bay City, Mich., has resigned. J. R. Decker has been appointed to succeed Mr. Lewis.

A dispatch from Constantinople states that the Turkish Chamber approved an agreement with the Oriental Ry. Co. for constructing a railway from Uskub via Kalkandele to Gostivar, about 39 miles.

The Atlanta & Macon, of Atlanta, Ga., recently incorporated with a capital stock of $100,000, is planning the construction of an 87-mile line, and is understood to be arranging details so as to start work as soon as possible. Kennett Cowan, Corn Exchange Bank Bldg., Chicago, Ill., is interested.

The Branchville & Bowman contemplates purchasing a 30 or 40-ft. light steel rail narrow gauge turntable. S. Dibble, president, at Bowman, S. C.

The Eastern Illinois & Peoria has been incorporated and proposes the building of a steam or electirc road from Peoria to St. Elmo. The incorporators are Frank R. Austin, Evansville, Ind., and Robert A. Dennis, Frank S. Nicholson, K. L. Richmond and Fred W. Krohn, all of Chicago. This is believed to be an extension of the Chicago & Eastern Illinois by which the Frisco will secure an entrance to Peoria.

The Chicago, Anamosa & Northern has under construction fifteen miles of line from Quasqueton, Ia., to Waterloo, Ia.

The Chicago, St. Paul, Minneapolis & Omaha, it is announced, will construct a double track from Eau Claire, Wis., to the head of the lakes.

The Columbus, Chattahoochee Valley & Atlanta has been incorporated in Georgia with $500,000 capital, by residents of Columbus, Ga. The plans call for building from Columbus, south to a point on the Gulf of Mexico. An extension will probably be built to Atlanta.

The Fairchild & Northeastern has 22 additional miles under construction.

A contract awarded the Utah Construction Co., Odgen, Utah, for building the Fernley & Lassen, of the Southern Pacific covers 107 miles of line, extending from Fernley, Lyon County, Nevada, to Susanville, Lassen County, Calif. The contract does not include bridge and trestle work, but does include concrete masonry.

The Gallatin Valley is extending its line 31 miles out of Bozeman. I. J. Busch, Bozeman, Mont., superintendent.

The Great Northern has opened a new branch on the Minot division from Stanley, N. D., northwest to Wildrose, 52 miles.

Surveys are under way for a line of railroad for the Louisville & Nashville from Irvington, Ala., to Alabama Port, Ala. Irvington is on the main line between Mobile and New Orleans, and the branch will give the road another outlet to the gulf.

The Idaho Northern is constructing a line from Emmett to Big Payette Lakes, a distance of 103 miles, and expects to have same completed by the end of the year.

The Rock Island, Farwell & Southern, projecting a 190-mile line from Farwell, Tex., south to the Texas & Pacific, has completed surveys and has partly secured the capital for construction purposes. Construction contracts will be let soon. J. J. Fry, Farwell, Tex., is chief engineer.

The Paris & Mt. Pleasant has under construction 30 miles of line to Mt. Pleasant. C. F. Collins, car accountant, at Paris, Tex.

The Shearwood, of Brooklet, Ga., has applied for a charter. The capital stock is $350,000, and the company proposes a line to run from Claxton, in Tattnall County, through Brooklet and Egypt to Clyo, in Effingham County. Among the incorporators are John A. Calhoun, of Philadelphia, M. A. O'Byrne and John E. Foye, of Savannah; George M. Brinson, of Springfield, and J. N. Sherwood, of Brooklet, Ga. The last named is president of the Shearwood Ry., which is now operating between Brook- understood to include a joint investment of $2,000,000 with the Manufacturers Ry.

The San Diego & New York Engineering Corporation has applied for articles of incorporation in Arizona. The special objects of the corporation are to make surveys and locate a line of railroad to run from San Diego, Cal., through the states of California, Arizona, New Mexico, Texas, South Carolina, North Carolina, Virginia, District of Columbia, Maryland, Pennslyvania and New Jersey; to establish a short line steam railroad between San Diego and New York City by constructing and acquiring control by traffic agreements

and otherwise with roads already constructed by which to establish the shortest possible rail route between New York and San Diego. The incorporators are: George H. Peet, Granville; A. Richardson, Guy W. Thaxer, of Roswell, N. Mex; Fred Beckley, John Tonge, 215 Andres Bldg., Minneapolis, Minn., and A. I. Beall, Sigourney, Ia.

The Southern Pacific has filed an application for permismion to install six spur tracks in the industrial district between Atlantic and Shearer Sts., Los Angeles, Calif. The company also wants permission to install four spur tracks on Alameda St., from Marchessault St. and Macy St.

The Wilmington, New Castle & Delaware City has been incorporated with a capital stock of $250,000, for the purpose of constructing, maintaining and operating railways. Robert H. Richards, Wilmington, Del., is counsel for the company.

The Boston & Albany will construct a third track at South Framingham, N. Y., the estimated cost of which is $55,000.

The Chicago, Milwaukee & Puget Sound, it is said, is about to award contracts for the construction of 140 miles of railroad into the Judith Basin, in Montana. The new line will extend between Lewiston, Mont., and Great Falls, Mont.

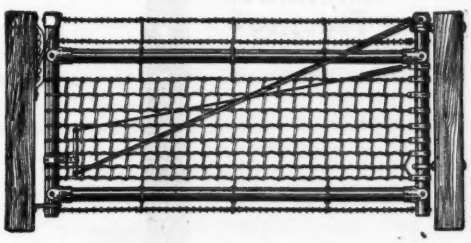
The Denver & Rio Grande, it is said, will build a detour around Soldier Summit, Utah.

The Long Island R. R. has awarded a contract to W. H. Gahagan, Inc., Brooklyn, N. Y., for the reconstruction of about 6,000 ft. of the Manhattan Beach division of the Long Island in East New York; including a four tube tunnel about 3,530 ft. long at East New York, and an embankment extending from about Granite street to the borough line. The estimated cost of the work is $1,140,000, not including the steel. The work will require 80,000 cu. yds. of concrete for the tunnel linings, reinforced with 4,636,000 lbs. of steel rod; 437,000 cu. yds. of soil will be excavated and 370 tons of structural steel required.

With The Manufacturers

GATES FOR RIGHT-OF-WAY FENCING.

The popularity of a railway through almost any territory and especially agricultural districts can be estimated by investigating the character and condition of its right-of-way gates. Little is so appreciated by farmers along the lines as good right-of-way gates—gates that operate so easily that the farmer will surely close them and take pleasure in doing so—gates that afford complete and lasting protection to stock of all kinds. With such gates the right-of-way is kept clear of stock and the very large sums which otherwise would be paid out annually in stock claims and such as are paid out by lines poorly gated are avoided at a trivial expense, considering the great saving effected.



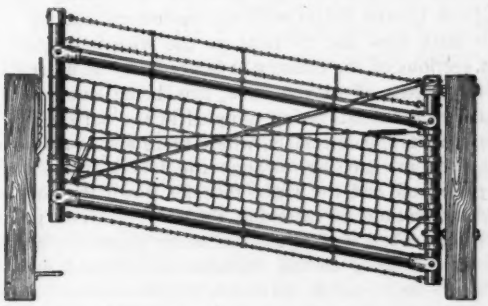
American Gate Closed.

In Texas one railway operates 3,000 miles with an average of four gates to the mile, which means 12,000 gates. This road uses board gates which average about four years of life, and including the amount paid out in claims annually for "stock killed" with the original cost of the gates and the repairing of same, the total cost is $8.00 each. On 12,000 gates this means an investment of $96,000 that will depreciate 25 per cent per year making an annual expense of $24,000. The same condition exists comparatively on many of the railroads in the United States.

On 90 per cent of the railroads of the United States the prevention of the stock claims or damage suits of that nature would pay in three or four years—sometimes less—for the entire cost of putting in good stock proof gates. The gate shown in the illustrations herewith is known as the American self-lifting galvanized high carbon steel right-of-way gate. This gate is of excellent construction, convenience and economy, and is self-lifting in action.

It will be noted by referring to the illustrations that this gate has a positive locking ratchet device which holds it down to a fixed position. When the ratchet is released the spring lifts the gate up away from obstructions such as snow or ice. This feature makes it very easy to open and close the gate.

When the gate is closed, an iron loop, attached to a ratchet on the gate post, is thrown over the end post of the gate frame. As the gate is forced down the loop catches on sucessive lower notches. The gate can be forced down by a man's foot until the bottom of the gate is in positive contact with the ground, and the ratchet will hold it in this position. The gate can very easily be pushed down through the snow in the winter time,



American Gate Spring Up, Ready to Open.

and yet when released it springs up and does not have to be dragged through the snow as an ordinary gate must.

Owing to the fact that the device is of open wire and tube construction, snow does not drift in behind it as is the case with the board gate. In case it does become blocked up with snow, it can be raised at either end to swing clear.

In the construction of the framework the largest practicable steel tubing is used. This tubing is connected by malleable joints. The whole is carefully galvanized to prevent corrosion, unless black iron is specified.

The gate is made by the American Farm Gate Co., Kansas City, Mo. This concern has recently commenced the development of sales in the railway field and has secured the adoption of the gate on several of the larger systems. H. L. Goodwin, vice-president and general manager of the company, is in charge of railway sales.

New Literature

The Chicago Pneumatic Tool Co. has issued booklet number 117. This booklet discusses the subject of lubrication of Rockford motor cars. It is pointed out that many troubles arise in connection with the operation of motor cars which are entirely due to poor cylinder lubrication. Excellently designed machines cannot give the best satisfaction unless the parts are properly lubricated. The high temperature of a gasoline engine cylinder makes it especially hard to lubricate. The booklet asserts that a special kind of oil is necessary for air cooled cylinders, and still another kind of oil must be used for water cooled cylinders. The Chicago Pneumatic Tool Co. manufactures a cylinder oil for use in Rockford cars, the special features of which of which are enumerated in the booklet mentioned.

* * *

The Carbo Steel Post Co., Chicago Heights, Ill., has issued several booklets which describe different types of Carbo steel posts. This post is carbon steel and is claimed by the maker to be practically corrosion proof. There are a number of different designs for different kinds of fences. It is possible to make the steel post up in almost any design, and it has great strength and resiliency with minimum weight. The posts are set directly in the ground without concrete base or protection. A base plate on the bottom of the post gives wide bearing and covering area, so that it is practically impossible to pull the post out of the ground.

NEW STEEL POST.

The success of the "Carbo" steel post construction in agricultural and other applications, has warranted a railway department in the sales organization of its manufacturers, the Carbo Steel Post Co., Chicago Heights, Ill. J. E. Chisholm, 355 Old Colony Bldg., Chicago, has taken the railway representation for this post and will push its sale among the railways of the United States with his customary energy.

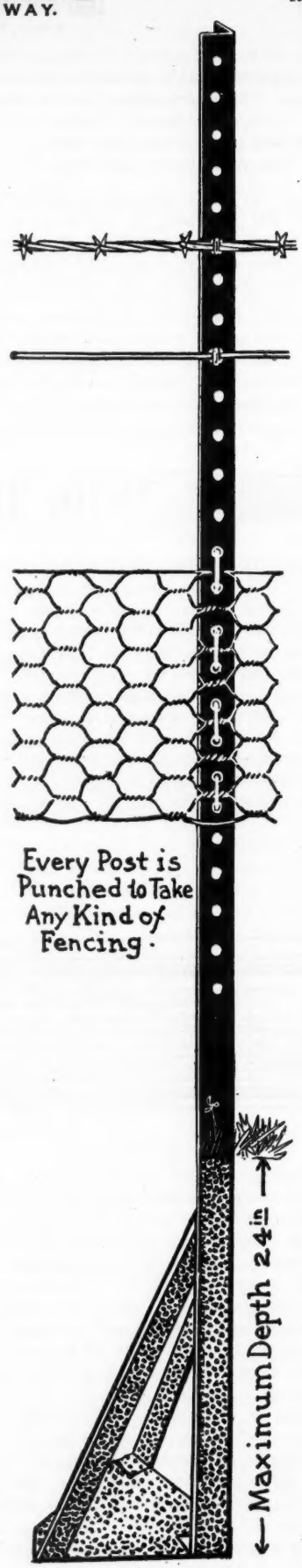
While barb wire still remains as the wire in largest use in most sections of the country, it is gradually being replaced by better grades of woven wire, this being due to losses sustained from animals being crippled in the barb wire.

Along railways, particularly, where there are so many trespassers, who are passing through the fences, wires are so easily pulled off and the fence thus let down that it seems the present method of fastening the wire to wood posts is not sufficient. And it is a fact that many posts of the right-of-way fences along certain railways are burned during a year. Therefore, it seems advisable to have a fireproof post, as the first cost of erection includes a considerable amount for labor and overhead charges.

The Carbo steel post has been on the market for the past two years. The first cost is said to be less than that of wood, there is no chance for burning or breakage and the method of fastening of wire by means of a standard staple is such that the wire cannot be pulled off and the design of the base is such that the post cannot be pulled out of the ground. The posts are nestable, and as many as 10,000 can be placed in one car.

What is the most important of all is the low cost of maintenance; all that is required to protect these posts is, preferably, to pour hot asphalt around the open cross section or right angle at the ground and repaint when necessary. With this small attention the post lasts indefinitely and should readily appeal to any railroad. The painting can be done at a cost of one-half cent for each post.

Carbo poles for telephone, telegraph and transmission work are of the same type of design as the fence posts, and are also set direct in the ground as are the posts, requiring no concrete.



Carbo Steel Post.

Industrial Notes

Mr. Edgar Lewis has resigned his position with the P. & M. Co., Railway Exchange, Chicago.

The Pittsburgh Testing Laboratory, Pittsburgh, Pa., has opened a branch office at 204 White building, Seattle, Washington, in charge of C. A. Perkins, district manager.

The H. W. Johns-Manville Co., New York, has moved its Winnipeg, Manitoba, offices to 92 Arthur street.

These companies which are controlled by the same interests, have moved their offices to the new Vanadium building, Pittsburgh, Pa.: the American Vanadium Co.; the Vanadium Sales Co. of America; the Flannery Bolt Co.; the Vanadium Metals Co.; J. Rogers Flannery & Co., and the Keystone Nut Lock Mfg. Co.

The General Fire Extinguisher Co. has announced the opening of its Western Heating and Power Piping Department. Mr. C. D. Allan is Dept. Mgr., with offices in the Society for Savings Building, Cleveland, Ohio, and Homer R. Linn is Sales Mgr., with offices at 108 South La Salle Street, Chicago. This company makes a specialty of steam and hot water forced circulation heating systems and power plant piping. Both Mr. Allan and Mr. Linn are experienced engineers in this line, having been formerly connected with Evans, Almirall & Co.

The L. M. Booth Co. has been given a contract by the Delaware & Hudson, to install a water softening plant at Watervliet, N. Y. The capacity is to be 60,000 gals. per day including a 20,000 gal. storage reservoir at the top of the machine.

Mr. O. Blume, recently assistant superintendent of construction with the New York Central & Hudson River, has opened an office in Kenwood, Fla., as a consulting engineer and contractor.

The Western Electric Co. has opened a branch office and a large warehouse at Houston, Tex.

The Boston Elevated has placed orders with the General Electric for a huge 15,000-k.w. turbine for the South Boston power house. This is equal to 20,000 horsepower and makes the three united capable of producing 60,000 horsepower in this one plant. The order also includes 800 motors for surface cars.

The Gulf, Florida & Alabama has purchased 100 miles of telephone wire from the American Steel & Wire Co.

The A. T. & S. F. is expected to start work shortly on the construction of a new concrete freight shed 500 ft. long and 40 ft. wide at Riverside, Cal. The cost of the work is estimated at $150,000.

Plans have been prepared for a new union passenger station at Dallas, Tex., for the use of ten railways.

The Buffalo, Rochester & Pittsburgh has given contracts for improvement work on a brick passenger station and office building at East Salamanca, N. Y., to George B. Elwell, Wellsville, N. Y., a brick passenger station at Warsaw, N. Y., to Porter & Nicholson, Warsaw; and a brick passenger station at Brockwayville, Pa., to G. F. Miller & Son, Salamanca.

It is rumored that the Boston & Maine has under consideration the construction of a new steel bridge over the river at Dover Point, Dover, N. H., to replace the old pile structure on the Portsmouth & Dover branch.

The Canadian Pacific is asking for bids on a four-story office building at Saskatoon, Sask.

It is reported that the Chicago, Milwaukee & St. Paul and the Minneapolis & St. Louis are working on plans for the construction of a new reinforced concrete arch bridge over the tracks at Lake St., Minneapolis. As proposed, two 140-ft. concrete spans will cover the five tracks of the two railroads. M. D. Rhame, Minneapolis, Minn., is District Engineer of the C. M. & St. P.

The Chicago & North Western will begin work at once on an addition to its freight house at Milwaukee to cost about $150,000, and will elevate its tracks from National avenue to the Kinnickinnic river and along Milwaukee river, at a cost of about $1,000,000. This company will also build a 60-stall roundhouse and machine shop at Green Bay, Wis.

Albert W. Merrick, 409 Boone National Bldg., Boone, Ia., has been awarded the contract for the foundations for the steel viaduct, 2¼ miles north of Boone, for the Fort Dodge, Des Moines & Southern. The work will include 28 piers containing approximately 740 cu. yds. of concrete.

The El Paso & Southwestern has awarded a contract to W. L. Pearson & Co., of Houston, for the construction of a new freight station warehouse and roundhouse at El Paso, Tex.

The American Car Screen Co., of Pittsburg, Pa., has received an order to equip 25 sleeping cars with the Scott No. 2 adjustable car window screen for the Grand Trunk, and also an order from the Hocking Valley, for officer's private cars. This company is now manufacturing car screens at Hamilton, Ontario, under Canadian patents.

The Cambria Steel Co. announces the removal of its Chicago office to suite 1860 McCormick building. Mr. Clifford J. Ellis is district sales manager.

The Great Northern has awarded contracts in Washington as follows: For the rebuilding of the main line between Interbay and Metum, a station a few miles north of Ballard, involving an immediate expenditure of more than $1,250,000. The Butler Construction Co., Seattle, was awarded the building of 15 concrete piers and the sub-structure of the new bridge crossing the Lake Washington Canal.

A proposition is under consideration for the construction of a spur line from the Atchison, Topeka & Santa Fe from the siding at Perea, N. Mex., 6 miles above Wingate, south about 25 miles to a place where a large saw mill is to be constructed.

The Boston & Maine is constructing a double track for a short distance north of Greenfield and is also making studies to double track through to South Vernon.

The Canadian Northern has 853 miles of new lines under construction. Extensive harbor and terminal improvements are being carried out at Port Mann, B. C.; the plans have been approved and work is to be started soon on large terminal shops and yards.

The Chicago, Burlington & Quincy has closed deals for the purchase of additional terminal lands in Denver involving $100,000. The newly acquired property is to be used in connection with its expected new right of way through Market Street.

The Chicago, Milwaukee & St. Paul has let contracts for second-track work from Hopkins, Minn., to Cologne, 23 miles, to A. B. Cook & Co., St. Paul; and from Twin Brooks, S. Dak., to Summit, 15 miles, to John Marsch, Chicago.

The Chicago, Milwaukee & St. Paul has received bids for double track work between Coon Rapids and Council Bluffs.

The Chicago, Springfield & Cairo has been incorporated in Illinois with $10,000 capital and headquarters at Chicago to build from Chicago, south to Springfield and Cairo. The incorporators are D. P. Phelps, M. C. Myers, C. G. Fox, J. T. Darling and W. C. Gregory, all of Chicago.

J. N. Gillis, Brewton, Ala., and C. J. Paramore, Birmingham, Ala., have been awarded a contract by the Mississippi Eastern for 20 miles of line from Quitman, Miss.

Recent Engineering and Maintenance of Way Patents

SECTIONAL CULVERT.

1,030,298—Charles Haines, assignor to the Canton Culvert Co.

A culvert comprising complementary sections, each section having seam flanges provided at its marginal edges with spaced lugs formed integrally with the flanges, the lugs bent over the flanges of the complementary section for fastening the sections together.

TRAIN SIGNALING MECHANISM.

1,030,307—Harold Jarvis, Buffalo, N. Y.

A train signaling mechanism comprising a railroad track upon which the train runs, an electric conductor arranged lengthwise of the track, an electric translating device arranged on the train and electrically connected with the track and conductor, and means for electrically connecting the conductor and track adapted to be operated by a landslide or avalanche and comprising a grid normally arranged upright adjacent to the side of the track and provided with vertical contact members which electrically connect the conductor and track upon moving the grid into a horizontal position over the track and conductor, posts supported on the ground at the side of the track and pivotally supporting the grid at its lower end and retaining stakes pivotally connected with the upper part of the grid and entering the bank of earth at the side of the road bed.

RAIL JOINT.

1,030,365—W. D. Williams, Kirkland, Ariz.

A base plate, a clamp on one side thereof, a removable clamp on the other side thereof, the clamps having flanges at their upper ends for supporting the head of the rail, there being a space between the lower flange of the rail and the base plate; the base plate having ribs on the underside adapted to bear against the inner edges of the supporting ties and having ribs between the first ribs, the base plate having orifices over the ties.

CROSS TIE AND RAIL FASTENER.

1,030,407—C. L. Inman, Seneca, Neb.

In combination, a tie having a channel across its face, a cruciform cushion having a thickened portion fitting in the channel and the other portions projecting over the face of the tie at the sides of the channel, a rail resting on and passing over the thickened portion, and clamps arranged on the portions of the cushions projecting over the face of the tie and engaging the base flange of the rail.

RAILWAY SIGNALING SYSTEM.

1,030,436—L. H. Thullen, assignor to the Union Switch & Signal Co., Swissvale, Pa.

In a signaling system for an electric railway the trackway of which is included in the circuit for the propulsion current, a source of alternating propulsion current, a track circuit, a source of alternating signaling current connected with the track circuit and differing in character from the propulsion current, a relay having two windings each of which is connected with the track circuit, and means included in the circuits of the windings for balancing the flow of propulsion current and for unbalancing the flow of signaling current in the two windings.

RAIL JOINT.

1,030,549—F. L. Strouse, Williamsport, Pa.

In a rail joint, a primary rail provided in its ball with a transverse recess, there being a bead overhanging the recess and a lug located in the recess, the ball having a lip disposed opposite to the recess, a portion of the web of the rail and a portion of the flange of the rail projecting beyond the lip to define a shoulder in the web; and a secondary rail provided in its ball with a transverse recess adapted to receive the bead of the primary rail, there being a finger below the recess of the secondary rail adapted to fit within the lip of the primary rail and to engage with the lug, the ball of the secondary rail having a shoulder in its outer face, arranged to engage the lip of the primary rail; the web of the flange of the secondary rail being set back from the end of the ball of the secondary rail, and the web and the flange of the secondary rail being shouldered to engage with the shoulder of the primary rail.

CATTLE GUARD.

1,029,854—J. W. Cooper, Brinkley, Ark.

In a cattle guard, pivoted gates and pivoted platforms below the gates, arranged end to end, the platform and gates simulaneously operatable by the depression of the outer end of one of the platforms to elevate the inner ends of the platforms and the gates.

DISTRIBUTER FOR DUMP WAGONS AND CARS.

1,029,894—E. E. Shellenger, Riverside, Cal.

A distributing attachment for dumping vehicles including a hopper open at the top and bottom and comprising opposed sides, a rearwardly and downwardly inclined front and a rear end, the front end of the hopper extending downward and rearward below the sides and rear end of the hopper, runners disposed beneath the forward end of the hopper, angular supports extending down against the front side of the front end of the hopper and extending along and attached to the runners, and draft bars attached to the sides of the hopper and to the runners and extending forward and adapted to be connected to a wagon to permit free vertical movement of the distributing attachment independent of the wagon.

RAIL CROSSING.

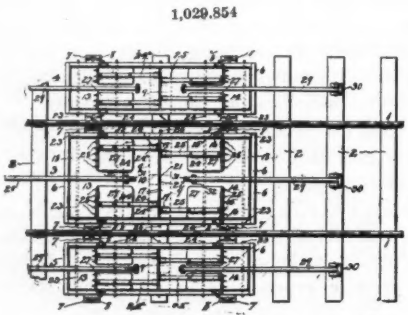
1,029,978—Charles Diedreach, Stockton, Cal.

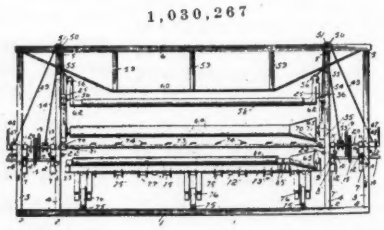
A railway crossing comprising the combination with a railway intersection, of two blocks pivotally mounted on each side of the intersection and being held in normal contact with the sides of the rails, two sliding rails on each side of the inside of the intersection, levers connected with each of the sliding rails, rods connected with the levers, bell cranks with the rods, links connected with the bell cranks, and links connected with the last named links and with the blocks.

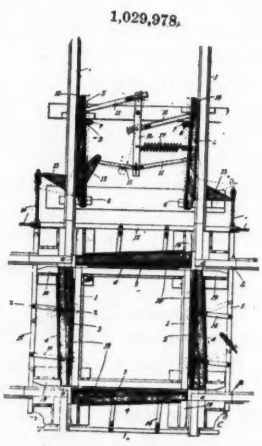
CONCRETE PILE MACHINE.

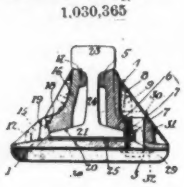
1,030,267—H. A. Riemann, Hannibal, Mo.

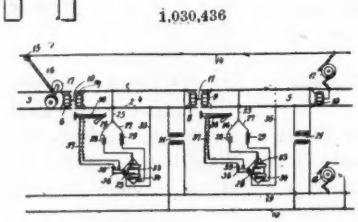
A pile making machine having in combination, a supporting standard, a core shaft, a horizontally traveling platform, a pivotally held finishing roller, a vertically reciprocating former roller, means for rotating the core shaft and synchronously moving the platform in a horizontal plane, the finishing roller in an arc and the former roller in a vertical plane.

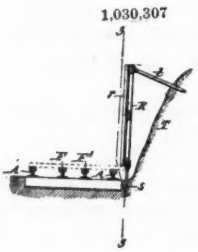


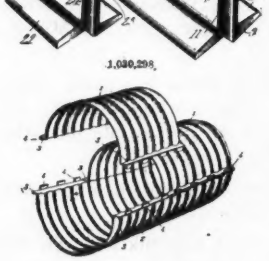


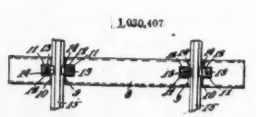


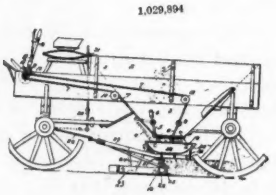












New Dixon Railroad Booklet

We have just prepared a booklet treating of the various Dixon graphite products for use on the railroad. The entire Dixon railroad line is treated of and all other matters excluded—this booklet is of interest only to the various mechanical railroad departments.

The application of dry graphite for lubrication, the use of Dixon's graphite greases, Dixon's Silica-Graphite Paint, crucibles, facings, crayons, etc., is all included in this booklet—a total of 40 pages. There is bound to be some matter to interest you here.

We have tried to make our booklet attractive in appearance as well as interesting to read, and to this end have included views taken of railroad stations and yards, stretches of track, signals, bridges, etc.

Write for copy of this booklet by number 187 R. R.

Joseph Dixon Crucible Co.

Jersey City, N. J.

ELLIS PATENT BUMPING POST

Noted for Simplicity, Strength and Lasting Qualities. Adapted to all positions.

Mechanical Mfg. Co.,
CHICAGO, ILL.

THE CLARK NUT LOCK

Absolutely
SAFE
Absolutely
ADJUSTABLE

The Interlocking Nut & Bolt Co.
605-606 Arrot Office Bldg.
Pittsburgh, Pa.

The Trackman's Helper

Revised Edition—by J. KINDELAN

A Practical Guide for Track Foremen

Thirtieth Thousand

"It is so very plain and easily understood, its value to men of ordinary education cannot be estimated."—D. A. Dale, Roadmaster, West Shore Ry.

"I find the Revised Trackmen's Helper the most generally instructive and useful book for trackmen that is now obtainable. I think every Track Foreman and Roadmaster should have a copy of it."—D. Sweeney, Roadmaster, C., R. I & P. Ry.

350 pages; fully illustrated, 5¼x7½ inches. Price, $1.50, net postpaid.

Practical Switch Work

By D. H. LOVELL
Division Superintendent Pennsylvania Ry.

An Instructor and Guide for Roadmasters, Section Foremen and Construction Foremen

This book is presented in a very clear manner, which is at once simple, thorough and practical.

The contents include chapters on General Turn-outs; Stub and Split Switches; Analysis of Curves; and a large number of tables for the quick and correct construction of any switch.

Cloth, 174 pages; 4½x6¼ inches. Price, $1.00, net postpaid.

Maintenance of Way Standards, by F. A. Smith, M. E., C. E. - Price, $1.50
Standard Turn Outs on American Railroads, by F. A. Smith - Price, 1.00
Railway Curves, by F. A. Smith - - - - - - - - - Price, 1.00

Descriptive Circulars upon Application

The Myron C. Clark Publishing Co.
Heisen Building, Chicago

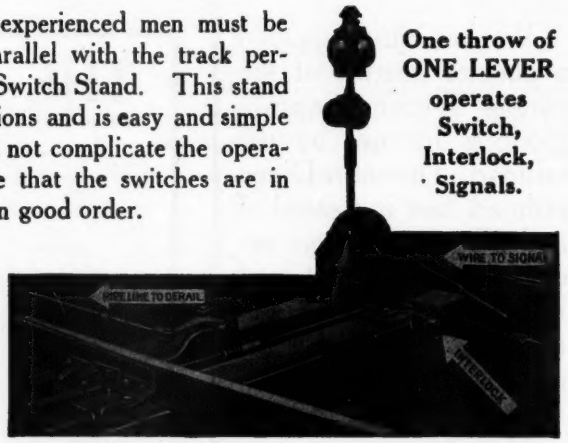
FOSTER

Interlocking Switch Stand

You make a careful inspection of switches to see that they hold the points up to the rail. The Foster Interlocking Switch Stand guarantees the points to be up to the rail and secured with two separate connections from the points to the ties. The lever will not enter the latch until the point is up to the rail and bolt locked. If there is lost motion in the connections or an obstruction between the point and the rail the lever cannot be forced down into the latch. With this stand the points must be kept adjusted within safe limits to be able to operate the stand.

Any track device which is not operated by experienced men must be simple and positive. One throw of one lever parallel with the track performs all operations with the Foster Interlocking Switch Stand. This stand guarantees safe switches between times of inspections and is easy and simple to operate. It provides additional safety and does not complicate the operation of your switches. Your inspection is to see that the switches are in good order and this stand is made to keep them in good order.

One throw of ONE LEVER operates Switch, Interlock, Signals.



Foster Interlocking Switch Stands have been tested in service and do all that is claimed for them.

Frank M. Foster

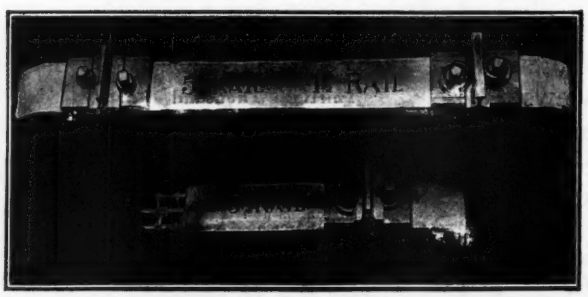
515 W. First Ave., Columbus, Ohio

The Universal Concrete Tie

Note carefully the details of the spiking device and the peculiar "V" shape of the base of the Tie at the center, which insures an absolutely perfect alignment, obviates spreading of the rails, or the slewing of the track. The heavy hardwood cushions preserve the rolling stock as well as the tie; last for six to fifteen years, and are then almost instantly removed by the loosening of the screw spikes by one man.

The Percival Patents

In use under various Trunk Line Railways for five and six years past.



For further facts and full evidence, address the

UNIVERSAL CONCRETE TIE COMPANY

1408-9 Whitney-Central Bldg. NEW ORLEANS, LA.

The above cut illustrates the Universal Concrete Tie.

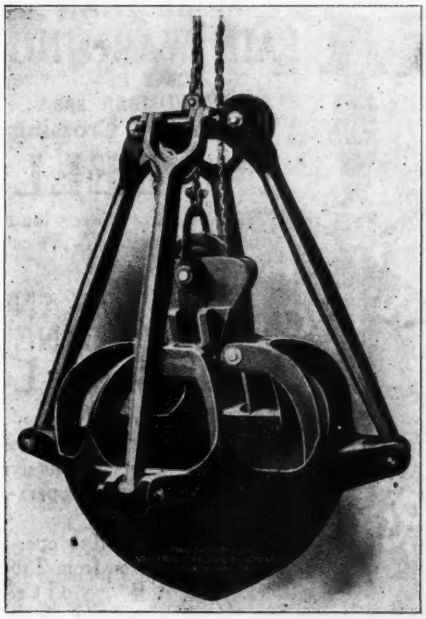
Trains are running sixty miles an hour over these ties, and have been so running for more than five years, yet they have had no repairs, realigning or even tightening of the spiking devices.

The reinforcement of our ties consists of four corrugated bars, the approximate length of the tie, and varying in size from 1-2 in. to 1 in. These are secured in proper shape by electro-welding the heavy binding wires. The truss core of the tie thus forming a complete unit within itself.

The best tie for terminals, because it is permanent.

The best tie for yards, because it is fire proof, rust proof, and will hold rails true to gauge.

The best tie for main lines and heavy traffic, because it is absolutely dependable under all conditions, as we can show in roads using them.



Rickards Cast Steel Orange Peel Buckets

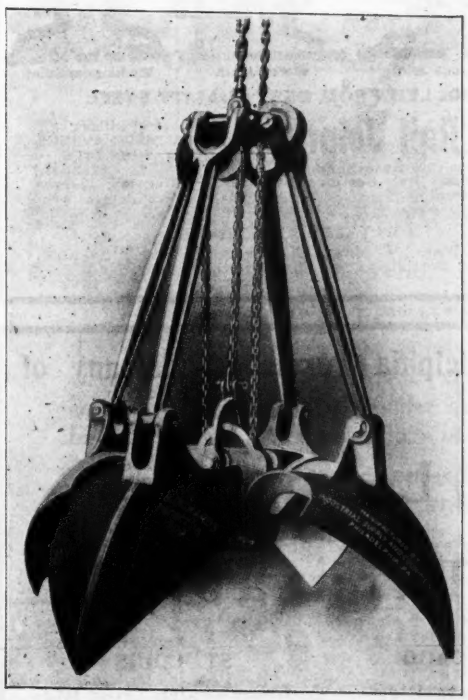
The Bucket for Hard Service

Rickards Orange Peel Buckets are constructed with four curved triangular cast steel blades, and when closed form a tight semi-spherical bowl, which holds the excavated material.

Rickards Bucket parts are interchangeable and are numbered and lettered. Reference to the number of the bucket being all that is necessary in ordering any part.

The Center Block is made of cast steel and fitted to carry and allow the bucket to hang central at all times.

All buckets are fitted with chain wheels, as this construction has been found more desirable. Buckets to be operated by wire rope will be furnished if so ordered.



The Rickards Orange Peel has been so designed that three sizes of blades can be used on the same crown rigging. That is, you can buy say a 1 yard Bucket and also buy ¾ yard and 1¼ yard blades for same rigging.

The Industrial Supply And Equipment Co.

407 Sansom Street, Philadelphia

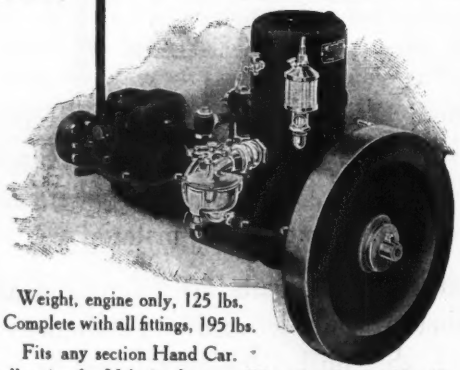
AGENTS:—J. H. Allen, 2 Rector Street, New York City; Willis Shaw Machinery Co., 39 S. LaSalle St., Chicago; W. H. Dayton, Security Building, St. Louis; J. M. Van Harlingen, Chandler Building, Atlanta; A. H. Van Winkle, 160 Beale Street, San Francisco; L. W. Miller Co., Boston.

Make Your *Hand Car* ---into a *Motor Car*

You can easily install a **Belle Isle Motor**

on your hand car in a couple of hours. The engine will propel any load your car will carry. Save your laborer's strength for real maintenance work, instead of making him pump a back-breaking, slow-running hand car. With a gasoline car you will ***get there*** quicker—easier. You will have ***more time,*** your laborers will have ***more strength*** and ***more inclination*** to do a full day's work.

4 to 5 H. P. = 20 Man Power



Weight, engine only, 125 lbs.
Complete with all fittings, 195 lbs.

Fits any section Hand Car.
Smaller size for Velocipedes. Write for Catalog No. 40

CONCRETE FORM & ENGINE CO.
502 Wayne County Bank DETROIT, MICH.

MORE THAN
FAIR WARNING
—Given By—
OUR NUMBER 333
Locomotive Crossing
BELL

Gives a very loud and distinct warning

IT IS AN ENGINE BELL

The gravity operated circuit closer absolutely insures its operation.

Wound to operate on from 2 to 600 volts. Equipped with contacts for operating an

Illuminated Signal

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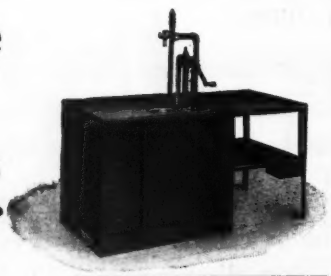
BRYANT ZINC COMPANY
SIGNAL SUPPLIES
Chicago New York

Bowser Table Tank for Way Stations



It just fits the conditions at way stations or oil houses for cleaning and filling signal lamps.

The pump measures the oil into the lamp and the table catches any dirt or spilled oil. The table serves also as an ideal place for trimming and cleaning the lamps.

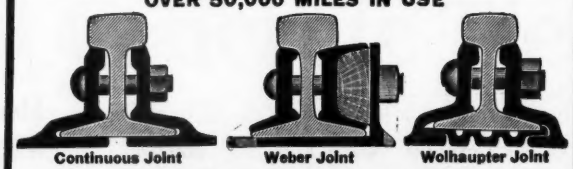
This is but one unit of the

Bowser Storage Systems

which covers the entire oil storage field. Get our illustrated book No. 40. Free.

S.F. Bowser & Co., Inc.,
Ft. Wayne, Ind.

OVER 50,000 MILES IN USE



ROLLED FROM BEST QUALITY STEEL

The Rail Joint Co. General Offices: 185 MADISON AVENUE, NEW YORK CITY

Makers of Base-Supported Rail Joints for Standard and Special Rail Sections, also Girder, Step or Compromise, Frog or Switch, and Insulating Rail Joints, protected by Patents.

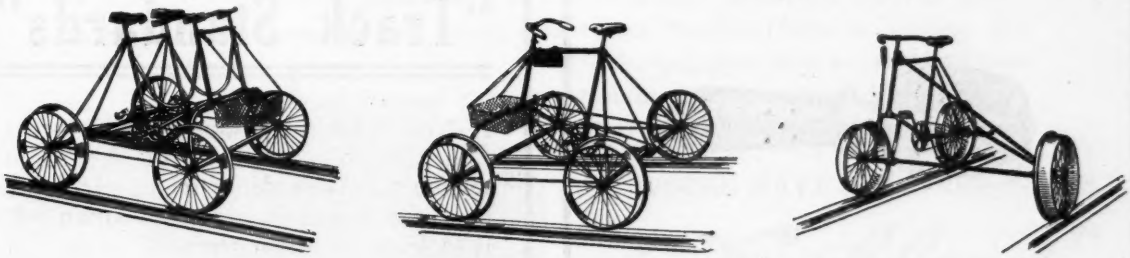
CATALOG AT AGENCIES
Boston, Mass.; Chicago, Ill.; Denver, Colo.; Pittsburgh, Pa.; Portland, Ore.; St. Louis, Mo.; Troy, N. Y.

Philadelphia Turntable Company of Philadelphia

Locomotive
and other
Turntables

CHICAGO Marquette Bldg.
ST. LOUIS Commonwealth Trust Bldg.

HARTLEY & TEETER



Light Inspection Cars are the Strongest and Lightest running known. The fact that we have not had a single complaint for the past year is proof absolutely that our cars are giving entire satisfaction. We shall be pleased to supply you with our new catalog that tells all about them.

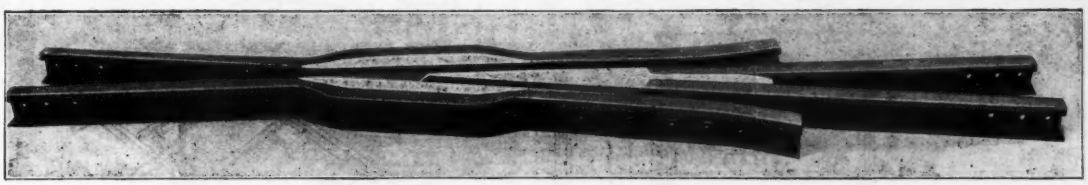
LIGHT INSPECTION CAR CO.

HAGERSTOWN, INDIANA

DEPENDABLE MANGANESE

is what you want. That is what you get when you order your manganese frogs from the ***Frog, Switch and Manufacturing Co.***

Our products are the result of 30 years' experience in the field.



Manganese Hard Center Frog—Patented

Wing rail pieces, throat, point and heel blocks are one manganese casting. The entire wearing surface of this frog is so completely protected with manganese steel that it is especially adapted for use under the most severe traffic. The manganese insert extends beyond the ends of the wing rails in the throat of the frog.

We have one of the largest and most modern plants in the country, and are prepared to give your orders ***prompt attention.***

Solid Manganese Frogs and Crossings—Manganese Switch Points

Established 1881

The Frog, Switch and Manufacturing Co.

CARLISLE, PA.

Universal Binding Post Wrench

An insulated socket wrench to fit R. S. A. binding post nuts.

Price, Postpaid, 75c

Universal Railway Supply Co.

Formerly W. K. Kenly Co.

122 South Michigan Boulevard

Chicago

YOU NEED "Track Standards"

A New Book full of up-to-date information for every member of the Maintenance of Way department. It should be in the hands of every trackman who is looking for advancement.

PROFUSELY ILLUSTRATED

The Subjects Are

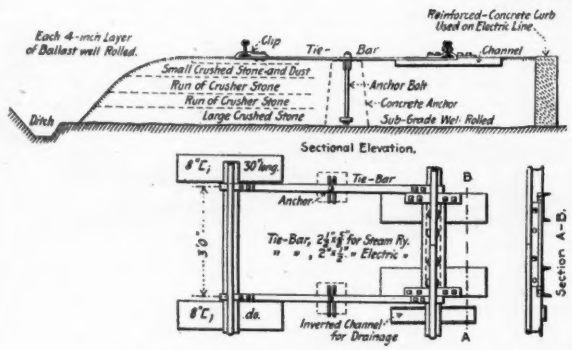
Roadway — *Switches, Turnouts, Etc.*
Ties — *Tie Plates*
Rail — *Cattle Guards, Fences, Signs, Etc.*
Rail Joints — *Derails, Rail Chairs, Etc.*
Rigid and Spring Rail Frogs — *Tools and Supplies*

Write us for special offer explaining how to get this book.

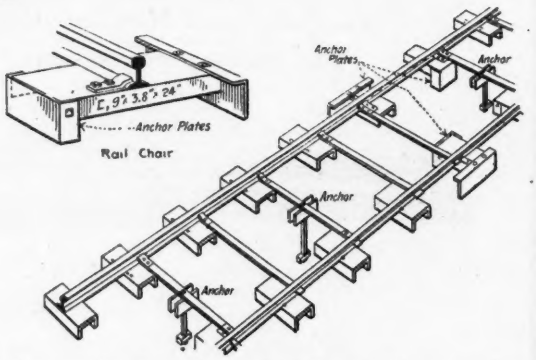
THE RAILWAY LIST CO.
MANHATTAN BUILDING CHICAGO, ILLINOIS

COFFMAN'S PERMANENT WAY

PATENTED



Track Construction with a watertight bed of rolled stone ballast.



Track Construction for very heavy traffic, used in connection with heavily rolled bed of broken stone.

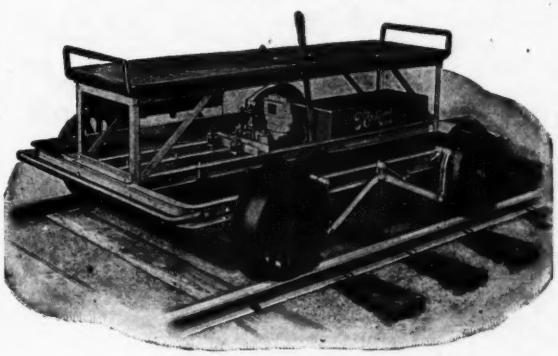
A reinforced compacted monolithic bed or permanent way is a support for the rails and rail chairs. The chairs may be considered under the head of tie plates. My bed represents both the ballast and wooden ties combined. A bed constructed on my plan will answer every condition required of both, and more too. The alignment is permanently maintained, as well as surface and gage. It will admit of the use of anti-creeper appliances. There is a scrapping value in the steel after being used. The bed will not settle out of sight in the soft ground and be lost. It is practically water-tight, and has a tendency to prevent the settlement of embankments. It can be constructed to carry wheel loads of 30,000 lbs. each at maximum speeds.

CHICAGO OFFICE
SPACE 50 12th floor Karpen Building
900 MICHIGAN BOULEVARD
Telephone Harr. 1147

W. H. COFFMAN, Inventor
BLUEFIELD, W. VA.

WE HAD IT ALL FIGURED OUT

We Knew That if we took the well-known *"Rockford"* Engine, and mounted it in a welded steel channel frame and eliminated dry cells, spark coil and timer, substituting therefor Magneto Ignition, and eliminated chain drive to cam shaft, substituting therefor direct drive through spiral gears, enclosed and running in oil



No. 4 Rockford Magneto Car

WE WOULD HAVE A WINNER IN THE

"Rockford" RAILWAY MOTOR CAR

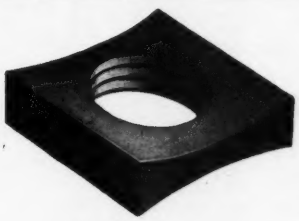
SEND FOR CATALOGUE NO. 40
AND CIRCULARS NOS. 103 - 104 - 105 - 116

Chicago Pneumatic Tool Company

CHICAGO 1010 Fisher Bldg. BRANCHES EVERYWHERE NEW YORK 50 Church St.

Simple *Efficient* *Economical*

Three Reasons Why The

BOSS  NUT

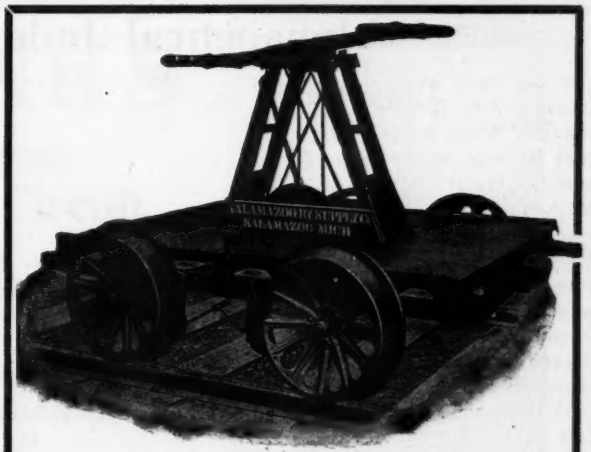
is attracting the attention and favorable comment of Railroad Men everywhere.

May we not have the privilege of showing YOU the many advantages and tremendous locking power of the **Boss Nut?**

A Post Card Request Will Bring Samples

BOSS NUT COMPANY

CHICAGO Commercial National Bank Building
NEW YORK 2040 Grand Central Terminal
ST. LOUIS Adreon Manufacturing Company



Kalamazoo Hand Cars

are equipped with the Kalamazoo Improved Reinforced Pressed Steel Wheel, giving 50 to 100 per cent greater wear than any other wheel of similar design or weight on the market. The car has stout gallows frame, thoroughly trussed, has taper wheel and pinion fits on axles, machine cut gears, flexible steady box and double acting brake.

16 Different Styles, Standard or Special

Catalogue of Track and Railway Supplies on Request

Kalamazoo Railway Supply Co.

Kalamazoo, Mich.

Western Representative: W. K. KENLY COMPANY, Chicago

RAILWAY ENGINEERING AND MAINTENANCE OF WAY

Result of ***perfect distribution*** and ***exclusive circulation*** in the Railway Engineering and Maintenance of Way field.

The circles in the above map show the locations from which inquiries came to one advertiser in *Railway Engineering and Maintenance of Way* from March 1st, 1912, to April 24th, 1912

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DO YOU KNOW?

BANKS designed the first assembled Copper Oxide Cell with Single Suspension.

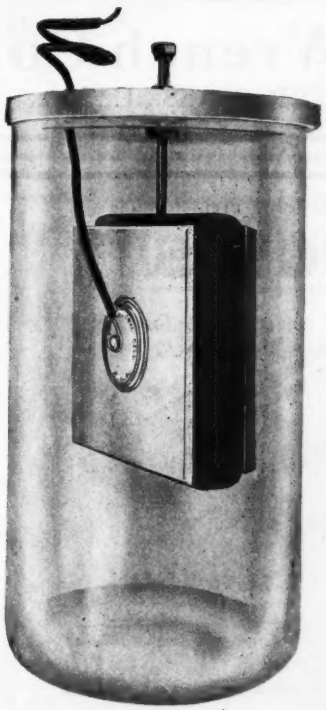
BANKS designed the first Assembled Copper Oxide Cell with Zinc beneath the Oil or Solution line. Zinc had wire attached,

BANKS designed the first Copper Oxide-Zinc-Alkaline Combination for Track Circuit Work.

BANKS was the first to Compress Copper Oxide in a Containing Grid of Metal for the ideal Negative Plate.

BANKS was the first to give you Rigid Construction in an Assembled Element with great Mechanical Strength.

BANKS was the first to give you a Track Circuit Cell with Automatic features in giving you a predetermined internal resistance during the life of the Elements.

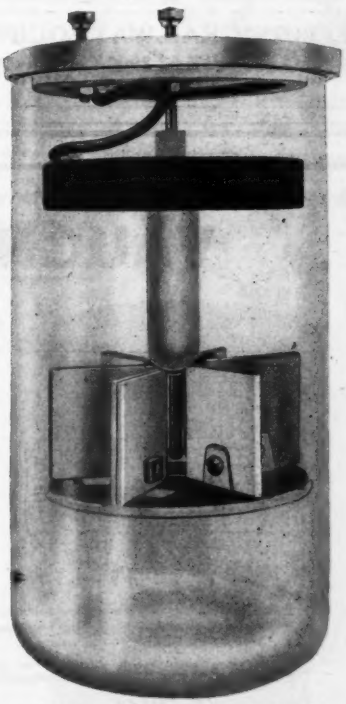


BANKS SIGNAL CELL, R. S. A.

ALL
of the Above Valuable Features are Contained in the

BANKS
Signal Track Circuit
CELLS

Which are Equipped With
N-W BINDING POSTS



BANKS TRACK CIRCUIT CELL

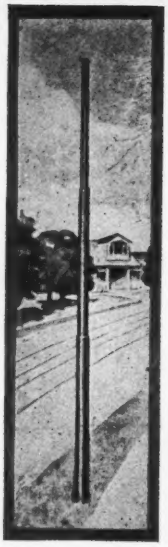
FOR FURTHER INFORMATION ADDRESS

Sole Sales Agents

Northwestern Construction Co.

HUDSON TERMINAL 50 CHURCH ST., NEW YORK CITY

TUBULAR POLES
IRON OR STEEL



for
Signal, Electric Railway and Lighting Service. Trolley Brackets Plain and Ornamental for Wood and Iron Poles. Line Material. Mast Arms.

Let us estimate on your requirements

ELECTRIC RAILWAY EQUIPMENT CO.
General Office, 2900 Cormany Avenue
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COES
KEY MODEL
EngineRoom
AND
Construction
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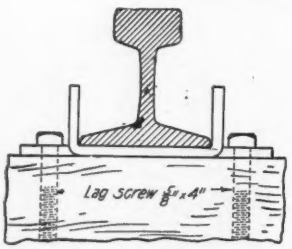
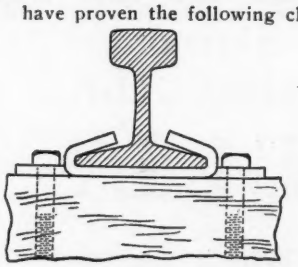
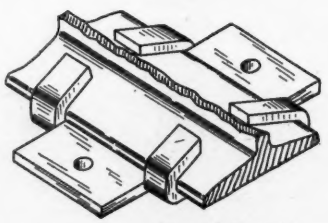
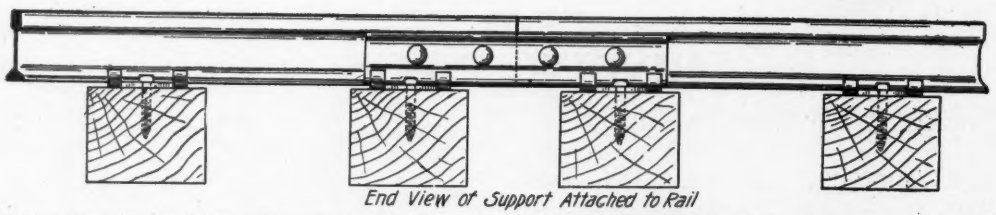


Side View
Support Ready for Application


Side View
Support Applied


View of Support
Attached to Rail.


End View of Support Attached to Rail

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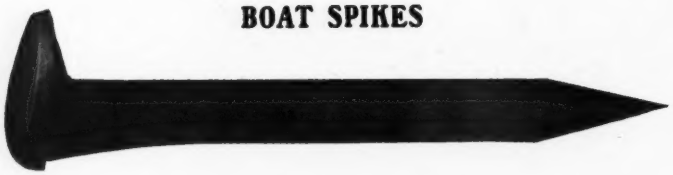

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